UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAR 0 6 2008

REPLY TO THE ATTENTION OF:
(AR-18J)

Richard Nelson, Field Supervisor
Rock Island Illinois Field Office
United States Fish and Wildlife Service
4469 48th Avenue Court
Rock Island, Illinois 61201

Dear Mr. Nelson:

Pursuant to Section 7 of the Endangered Species Act, (87 Stat. 884, as amended; 16 U.S. C. 1531 et seq.), the U. S. Environmental Protection Agency has reviewed the biological information and analysis related to a prevention of significant deterioration permit for Gateway Energy and Coke Company (GECC), Granite City, Illinois, to determine what impact there may be to any threatened or endangered species in the area around the proposed facility. The purpose of this letter is to seek concurrence from the United States Fish and Wildlife Service (USFWS) on our determination that the proposed project is not likely to adversely affect any federally listed species in relation to the proposed air quality permit for this facility.

The parties utilized the informal consultation process as specified in the Endangered Species Act (ESA) Consultation Handbook, procedures for conducting consultation and conference activities under Section 7 of the ESA, (March 1998 final), by the USFWS and National Marine Fisheries Service. EPA prepared this biological assessment following the guidance provided in the ESA consultation handbook, as well as the recommended content suggested in the ESA regulations found in 50 CFR Part 402.12(f). As part of developing the biological assessment, the designated representative for EPA prepared a Recommended Scope of Analysis for GECC, dated September 7, 2005, describing the general topics of need, species of concern, effects analysis, and literature search, needed in the biological assessment (Enclosure 1). GECC then prepared the August 2007 document entitled, "Ecological Risk Assessment (ERA) Screening Evaluation, Gateway Energy and Coke Company, Granite City, Illinois" (Enclosure 2). Additional information was submitted on November 2, 2007 (Enclosure 3) and February 18, 2008 (Enclosure 4).

Project Description

GECC proposes to construct a heat recovery coke plant adjacent to the United States Steel's Granite City Works (GCW) plant. GECC operates under contractual agreement as a support facility for the GCW plant. The proposed operations at the GECC facility will consist of 120 heat recovery coke ovens in three batteries. Operations at the facility will

include coal handling and processing, coal storage, charging, heat recovery coking, pushing, quenching, coke handling and processing and coke storage. Heat recovery steam generators will recover waste heat from the ovens to produce up to 740,000 tons furnace coke/year. A nominal 75 megawatts of electricity will be produced from waste heat.

Construction of GECC will also be accompanied by several other improvements at GCW that will result in net emission reductions of several air pollutants. The improvements at GCW will include shutdown of several boilers, installing low-nitrogen oxide (NO_x) burners in the slab furnaces, replacing a large gas-driven pump, and installing a coke oven gas de-sulfurization system to remove sulfur from the coke oven gas from the existing byproduct coke plant. The coke oven gas is burned in several slab furnaces at GCW.

As a heat recovery facility, GECC will not have a chemical by-product recovery plant, but will instead fully combust its flue gases, recovering energy from the process as steam. It will not generate any process waste water or hazardous waste. The ERA was based on potential emission of 58 hazardous air pollutants (HAPs) and carbon monoxide (CO).

Project emissions reductions and increases are summarized below:

	Net Emissions (tons/year)							
	PM	PM_{10}	SO_2	NO_x	CO	VOC	Pb	H_2SO_4
Heat Recovery Battery Project	326	267	1406	577	155	38	0.2	31
Boiler Replacement Project	41	41	95	-155	20	-0.3		
Planned Reductions	-92	-92	-2722	-544	-102	0.1		-63
Total Net Emissions Change	**275**	**217**	**-1220**	**-104**	**79**	**38**	**0.2**	**-32**

Action Area

The GECC is in the city of Granite City, in Madison County, Illinois. EPA considered the area within a 3 kilometer radius of the facility as the action area. EPA would anticipate that the majority of pollutants in the stack emissions would deposit from ambient air within this distance.

List of Species

The federally listed species evaluated in the consultation included:

- Decurrent false aster (Boltonia decurrens)
- Pallid sturgeon (Scaphirynchus albus)
- Least interior tern (Sterna antillarum athalassos)
- Gray bat (Myotis grisenscens)
- Indiana bat (Myotis sodalist)

The Bald Eagle was removed from the endangered species list on August 8, 2007. While GECC considered it in its analysis, it will not be discussed here.

Summary of Analysis

As discussed in the Protocol for E S Analysis (URS, 2007), the ERA screening evaluation used the EPA's draft document, Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (SLERA), (EPA, 1999) as a general guidance for conducting the evaluation. The air, soil, sediment and surface water concentrations for each of the HAPs were estimated using the Industrial Risk Assessment Program for Human Health (IRAP-h View) model, with the exception of CO. CO air concentrations were estimated using AERMOD. The estimated media concentrations were used in the ERA screening evaluation. The types of impacts that were considered in this ERA screening evaluation include direct effects to listed plants and animals exposed to the estimated media concentrations and indirect effects to animals from ingestion of plants, fish and invertebrates that have accumulated HAPs.

GECC performed modeling for emissions associated with the planned project. As recommended by EPA, GECC followed the procedures outlined in Chapter 3 of the EPA, Office of Solid Waste, November 1999, draft document SLERA , to estimate the soil, water and sediment concentrations of the chemicals of interest (COI) associated with this project. The AERMOD model was used to conduct air dispersion and deposition modeling rather than ISCST3. As suggested in the SLERA protocol, AERMOD replaced ISCST3 as EPA's required air dispersion model on December 9, 2006. Chemicals were modeled in the vapor phase, particle phase and/or particle-bound phase depending on their physical and chemical characteristics. Annual air concentrations and deposition rates were estimated with AERMOD over a period of thirty years of facility operation. The modeled air concentrations and deposition rates were then used to estimate media specific concentrations. The approach used to derive media specific COI concentrations was generally conservative. For each COI, the modeled or estimated media-specific concentration (soil, sediment, water) was compared to the most conservative and applicable toxicity reference value developed for that media. A more detailed explanation of the modeling performed by GECC is found in Enclosure 2.

ESA Effects Analysis

Criteria Pollutants

Ozone: The project will result in an increase in volatile organic compound (VOC) emissions of 38 tons per year. At the current time, EPA is unaware of any reliable means to assess ozone changes through point source modeling. Although point source screening

models have been developed, they have not been consistently applied with success for source changes of this small magnitude. Such screening models were developed for much larger VOC and NO_x sources and/or emissions changes. Urban scale photochemical ozone models, such as the Urban Airshed Model, could be employed to assess the ambient impact of emission increases as well as emission decreases resulting from the implementation of emissions control programs. Past experience, however, with such models indicates that a VOC change of 38 tons per year would not produce a predicted change in ozone concentrations. The Urban Airshed Model, for example, has been shown to be relatively insensitive to changes in VOC emissions. Past modeling results considering VOC emissions changes on the order of hundreds to several thousand tons per year of VOC major urban areas have shown only modest decreases in predicted peak ozone concentrations. Therefore, it is concluded that such models would likely show a zero ozone change for a VOC increase of 38 tons per year. Based on this information, EPA concludes the project will have no measurable effect, or possibly, no effect, on the endangered spieces with respect to ozone. At a minimum, the project is not likely to adversely effect the endangered spieces as no measurable change in ozone will result from the project.

SO_2: The projected increase in SO_2 emissions from the proposed project is 1406 tons per year. The project increase will not cause an exceedance of the primary or secondary National Ambient Air Quality Standards (NAAQS). While EPA did not specifically consider any of the listed species potentially affected by this project when establishing the NAAQS, the secondary standards were developed considering effects on vegetation. EPA is not aware of data that suggests the NAAQS would not be protective of the species potentially present within the action area.

NO_x: NO_x emissions are primarily a concern for the decurrent false aster. Nitrogen deposition can adversely affect plant species such as the aster by providing nutrients to competing plant species that do not similarly thrive in nitrogen-poor soils. The project is estimated to result in an increase in NO_x emission of 577 tons per year. Since the project includes permanent shutdown and removal of equipment, as well as emission reduction projects that will result in a decrease of NO_x of 699 tons per year, it is likely that nitrogen deposition in the area will decrease as a result of this project. Nevertheless, the risk associated with emissions of NO_x was modeled using actual emission rates. As such, the actual emissions of NO_x from the main stack and that from the proposed GCW blast furnace boiler and flare, along with the other GECC point sources were modeled using maximum annual NO_x emission rates.

For NO_x, maximum deposition rates (g/m2) were calculated by AERMOD and compared to the deposition Ecological Screening Level (ESL) for NO_x. In addition, the maximum calculated yearly air concentrations were added to the average background NO_x concentrations. The potential for NO_x emissions from the facility to pose a risk to the decurrent false aster was evaluated in this ERA screening evaluation by comparing the

NO_x calculated deposition concentrations and total air concentrations (maximum calculated air concentrations and the background air concentration) to an ESL and phytotoxicity guideline, respectively. The maximum deposition increase related to the project is 0.00505 g/m2, which is much less than the deposition ESL of 0.5 g/m2. The results of this screening evaluation of NO_x deposition indicate that the proposed construction of the GECC is unlikely to adversely affect the listed species in the area.

PM/PM_{10}: The project will result in an increase in PM emissions of 326 tons per year, of which 82% consist of PM_{10}. The portion of PM/PM_{10} emissions of concern for the potentially affected species would be a HAP component.

CO: The project is estimated to result in an increase of 155 tons per year of CO. The project increases will not cause an exceedance of the NAAQS for CO. While EPA did not specifically consider the species potentially affected by this project in the development of the NAAQS, EPA is not aware of data that would suggest that the NAAQS would not be protective of these species.

HAPs

Enclosure 2 provides tables showing the worst case modeled impacts for soil, surface water and sediment, background concentrations and benchmarks for the HAP emissions associated with this project. Cumulative risk of HAPs to the ecological receptors was evaluated by adding available background concentrations to the maximum estimated soil and sediment concentrations modeled by GECC. Background concentrations for soil were taken from the Illinois Environmental Protection Agency (IEPA) Tiered Approach to Corrective Action Objectives (IEPA, February 2007). The background soil values selected were those for metropolitan areas because the soils from around the facility are likely to contain concentrations similar to urbanized areas versus rural areas due to the influence of existing industrial air emissions in the region. The background concentrations for sediment were taken from Sediment Classification for Illinois Inland Lakes by Mitzelfelt (1996). Tables 1 and 2 present the total soil and sediment concentrations, respectively, compared to their media-specific ecological benchmarks. Many of the HAPs did not have available background concentrations and could not be cumulatively evaluated.

Based on the available information, the HAPs of greatest concern are antimony, arsenic, benzo(a)pyrene, cadmium, chromium, lead, mercuric chloride[1], methyl mercury[1], naphthalene, nickel, and selenium with respect to soil impacts.

Antimony: The background levels of antimony in soil exceed the benchmark. The project contribution of 2.27E-06 mg/kg is less than 0.01% of background and the

1 The ecological benchmark for mercury (total) was used.

benchmark. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered spieces in response to the project contribution.

Arsenic: The background levels of arsenic in soil exceed the benchmark. The project contribution of 7.03E-07 mg/kg is less than 0.1% of background and of the benchmark. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered spieces in response to the project contribution.

Benzo(a)pyrene: The background levels of benzo(a)pyrene in soil exceed the benchmark. The project contribution of 2.57E-04 mg/kg is less than 0.1% of background and of the benchmark. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an ES in response to project contribution.

Cadmium: The background levels of cadmium in soil exceed the benchmark. The project contribution of 2.44E-06 mg/kg is less than 0.1% of background and is 0.11% of the benchmark. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered spieces in response to project contribution.

Chromium: The background levels of chromium exceed the benchmark. The project contribution of 2.78E-02 is .17% of the background soil concentration and 7% of the benchmark. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to project contribution.

Lead: The background levels of chromium exceed the benchmark. The project contribution of 8.67E-04 is less than 0.1% of the background soil concentration and is 1.7% of the benchmark.

Napthalene: The background levels of naphthalene exceed the benchmark. The project contribution of 8.0E-03 is 4% of the background and 8% of the benchmark. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered spieces in response to project contribution.

Nickel: The background levels of nickel exceed the benchmark. The project contribution of 9.7E-06 is less than 0.01% of the background and benchmark values. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered spieces in response to project contribution.

Selenium: The background levels of selenium exceed the benchmark. The project contribution of 1.37 E-06 is less than 0.01% of the background and benchmark values. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered spieces in response to project contribution.

Methyl mercury and mercuric chloride: The initial modeling for these two pollutants indicated modeled concentrations in excess of the background soil concentrations and benchmark values. These elevated concentrations were likely due to very conservative assumptions and were not indicative of actual emissions or operating scenarios. For example, the original dispersion modeling used to support the risk assessment was based on the point source emission units from the proposed GECC facility, and used particulate matter emissions as the surrogate for mercury. This was a conservative approach especially considering that emissions associated with coke pushing activities accounted for most for the modeled unit-emission-rate impacts and deposition values. The revised analysis included only those point sources that will emit mercury, and does not include pushing activities. Tables 1 and 2 (February 18, 2008 submittal) present the comparison of cumulative estimated and background soil and sediment concentrations of mercuric chloride and methyl mercury for each receptor to ecological benchmarks. As shown in Table 1, the estimated soil concentrations for mercuric chloride are below the background concentration and the ecological screening benchmark. For methyl mercury, the estimated soil concentrations are several orders of magnitude lower than both background levels and the ecological benchmark. However, background concentrations for methyl mercury are above the benchmark. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered spieces in response to project contribution.

The estimated sediment concentrations for mercuric chloride are below the background levels and the ecological benchmarks. For methyl mercury, the estimated sediment concentrations are several orders of magnitude lower than background levels and at least one order of magnitude below the ecological benchmark. The background level of methyl mercury in sediment exceeds the benchmark. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered spieces in response to project contribution.

ESA Determination

After reviewing the analysis provided by URS Corporation, the pollutants with the greatest potential for adverse impact would include methyl mercury and mercuric chloride. However, due to the conservative assumptions made and the small contribution of these contaminants in comparison to existing background conditions or benchmarks,

EPA has concluded that it would not likely be possible to measure or detect an adverse response as a result of the proposed project.

Considering this analysis (see enclosures) in its entirety, EPA concludes that the proposed construction and operation of this facility may affect, but is not likely to adversely affect, any of the threatened and endangered spieces. EPA respectfully requests USFWS concurrence on this determination.

Sincerely yours,

Pamela Blakley

Pamela Blakley, Chief
Air Permits Section

Enclosures

Enclosure 1

Recommended Scope of Analysis for Endangered Species
Gateway Energy and Coke Company, LLC
Granite City, Illinois
August 24, 2006

Purpose of analysis:

The analysis is intended to determine whether the proposed construction of the Gateway Energy and Coke Company, LLC and the accompanying improvements at US Steel's Granite City Works (GCW) are likely to directly or indirectly adversely affect federally listed species. This recommended scope of analysis or roadmap recommends using USEPA's ecological risk assessment process to inform the decision points in section 7 of the Endangered Species Act. Portions of the USEPA's draft Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (EPA 530-D-99-001A) provides useful guidance for this analysis. Although this guidance was designed specifically to assess the impact of hazardous waste combustion facilities, it offers general approaches for assessing the fate of chemicals released to the air that can be applied to all types of industrial facilities.

Overall, the evaluation should focus on emissions from the facilities. To complete this analysis we need an understanding of the background concentrations and deposition patterns. The anticipated emissions from permitted but not yet operational facilities should be included in background. The anticipated concentration in air or deposition at sites supporting listed species should be compared against NOEL (No observed effects level) benchmarks thought to be protective of the appropriate group (e.g., plants). The evaluation should look at the incremental addition in the context of background concentrations.

Benchmarks:

For these analyses, commonly accepted NOEL (no observed effects levels) benchmarks should be used. Where more than one benchmark can be found, the most conservative value should be used, unless an explanation is given to justify a less conservative benchmark. When there is no commonly accepted benchmark, there should be a search of the scientific literature for relevant toxicity information to provide a basis for risk assessment for the species of concern.

Modeling protocol:

Modeling should follow the general guidance provided in Chapter 3 of USEPA's SLERA protocol for assessing chemical fate and transport. The modeling should show air concentrations and deposition rates for all pollutants (where appropriate). The air emissions resulting from the project should be modeled at the facility level, not on a unit basis. Total impacts should be evaluated looking at the combined effects of the vapor

phase, particle phase and particle-bound phase of pollutants. ISCST3 is an acceptable model for this analysis. For chemicals amenable to deposition, models in the SLERA guidance should be used to estimate concentrations in soil, surface water, and sediment in conjunction with relevant fate and transport parameters.

Background Levels:

Site specific background concentrations in air, soil, water and sediment should be considered in the effects analysis.

Suite of pollutants to consider:

The assessment should cover all air pollutants emitted from the facility including ozone, sulfur compounds, oxides of nitrogen, carbon monoxide, particulates, and hazardous air pollutants. USEPA will provide the analysis for ozone for this project.

Types of impact to consider:

1) Long term, depending upon pollutant. Compare the worst year of concentrations in air or deposition on soil (over the last 5 years) with appropriate bench marks for chronic effects.
2) Direct effects to listed plants and animals from exposure to the vapor phase, particle phase and particle-bound phase of pollutants.
3) The indirect effects to animals from ingestion of plants, fish, and invertebrates that have accumulated these pollutants.

Listed Species:

The species that should be evaluated for impacts from the project are the Bald Eagle, Indiana Bat, Decurrent False Aster, Gray Bat, Pallid Sturgeon and Least Interior Tern.

Enclosure 2

Delauna A. Pack
Director Corporate HES

SunCoke Energy, Inc.
11400 Parkside Drive
Knoxville TN 37943
865 288 5291 Phone
865 288 5280 Fax

August 15, 2007

Ms. Jennifer Darrow
USEPA Region 5
77 West Jackson Boulevard
Mail Code: AR-18J
Chicago, Illinois 60604-3507

Gateway Energy & Coke Company
Ecological Risk Assessment Screening Evaluation

Dear Jennifer:

Per the approved Protocol for Endangered Species Analysis in March 2007, please find the enclosed Ecological Risk Assessment Screening Evaluation for the proposed Gateway Energy & Coke Company facility located in Granite City, Illinois. The results of the ERA screening evaluation indicate that the proposed facility is unlikely to directly or indirectly adversely affect the federally listed species potentially present in the area.

As previously discussed, the Illinois EPA Bureau of Air Chief has requested that the ERA approval be obtained before the final air permit will be issued by the Agency. The release of draft permits for public hearing and comment periods is anticipated for September and forecasting final permit issuance in December 2007. We appreciate your efforts to meet these deadlines.

Please contact me at 865.288.5291 if you have any questions or need additional information.

Best regards,

Delauna Pack

cc:
M. Coffey, FWS
R. Rineheart, Region V
J. Schnepp, IEPA
L. Siebenberger, GCW

Ecological Risk Assessment (ERA) Screening Evaluation

Gateway Energy and Coke Company
Granite City, Illinois

Prepared for:

Gateway Energy and Coke Company
Granite City, IL

Prepared by:

URS Corporation
9400 Amberglen Boulevard (78729)
P.O. Box 201088
Austin, TX 78720-1088

August 2007

Table of Contents

Table of Contents (continued)

List of Tables

List of Figures

Acronyms and Abbreviations

AUF	Area use factor
BPIP	Building Profile Input Program
BSO	Benzene-soluble organics.
CLO	Cornell Lab of Ornithology
cm^3/g	cubic centimeters per gram
CO	Carbon monoxide
COC	Constituent of concern
COPC	Constituent of potential concern
CSM	Conceptual site model
DW	Dry weight
DWQC	Derived Water Quality Criteria
ERA	Ecological risk assessment
ESL	Ecological screening level
Ft	feet or foot
g/sec	Grams per second
GAQM	Guideline on Air Quality Models
GCW	Granite City Works
GECC	Gateway Energy and Coke Company
HAP	Hazardous air pollutant
HHRAP	Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities
HQ	Hazard quotient
HRSG	Heat recovery steam generator
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
INHS	Illinois Natural History Survey
IRAP-h View	Industrial Risk Assessment Program for Human Health
kg/day	Kilogram per day
km	Kilometer
l/day	Liter per day
L/kg	Liter per kilogram
LOAEL	Lowest observed adverse effects level
mg/kg	milligram per kilogram
mg/m^3	Milligrams per cubic meter
MDC	Missouri Department of Conservation
NA	Not available

Acronyms and Abbreviations (continued)

NAAQS	National Ambient Air Quality Standards
NOAEL	No observed adverse effects level
NPS	National Park Services
NWS	National Weather Service
ORNL	Oak Ridge National Laboratory
PAH	Polynuclear aromatic hydrocarbon
PSD	Prevention of Significant Deterioration
RAIS	Risk Assessment Information System
SIL	Significant impact level
SLERAP	Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities
SSL	Soil screening level
TRV	Toxicity reference value
UF	Uptake factor
URS	URS Corporation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WSL	Washington State Legislature

Executive Summary

The objective of this ecological risk assessment (ERA) screening evaluation was to determine whether the proposed construction of the Gateway Energy and Coke Company (GECC) adjacent to United States Steel's Granite City Works (GCW) in Granite City, Illinois, is likely to directly or indirectly adversely affect federally listed (i.e., endangered and threatened) species potentially present in the surrounding area. On August 24, 2006, U.S. Environmental Protection Agency (USEPA) Region 5 issued the ***Recommended Scope of Analysis for Endangered Species*** for GECC, referenced as "Roadmap" from this point forward. GECC developed a ***Protocol for Endangered Species Analysis*** (URS Corporation [URS], 2007) in response to the Roadmap. USEPA approved the ***Protocol for Endangered Species Analysis*** (URS, 2007) with comments that are addressed in this ERA, which is performed in accordance with the approved protocol.

GECC proposes to construct a heat recovery coke making facility adjacent to United States Steel's GCW in Granite City, Illinois. Operations at the facility will include coal handling and processing, coal storage, charging, heat recovery coking, pushing, quenching, coke handling and processing, and coke storage. As a heat recovery facility, this type of coke plant will not have a chemical byproduct recovery plant but will instead fully combust its flue gases, recovering energy from the process as steam. It will have state of the art air pollution controls and will not generate any process waste water or hazardous waste. Construction of the heat recovery coke plant will also be accompanied by several other improvements at GCW that will result in emission reduction of several air pollutants. The ERA was based on potential emissions of 58 hazardous air pollutants (HAPs) and carbon monoxide (CO).

As discussed in the ***Protocol for Endangered Species Analysis*** (URS, 2007), this ERA screening evaluation used the USEPA's draft ***Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*** (SLERAP) (USEPA, 1999) as a general guidance for conducting the evaluation at the request of USEPA Region 5 in the Roadmap for the GECC facility. The air, soil, sediment, and surface water concentrations for each of the HAPs were estimated using the Industrial Risk Assessment Program for Human Health (IRAP-h View) model, with the exception of carbon monoxide. Carbon monoxide air concentrations were estimated using AERMOD. The estimated media concentrations were used in the ERA screening evaluation. The types of impacts that were considered in this ERA screening evaluation included:

- Direct effects to listed plants and animals exposed to the estimated media concentrations; and

- Indirect effects to animals from ingestion of plants, fish and invertebrates that have accumulated HAPs.

The area surrounding the GECC and GCW facilities consists of industrial/residential areas as well as ecological habitats such as creeks, large water bodies (e.g., Horseshoe Lake and the Mississippi River), river floodplains, wetlands, and greenspace areas. The ERA screening evaluation was performed at identified ecological habitats located within a 3 kilometer (km) radius of GECC and US Steel's GCW (receptors R1-R5 and R7), with the exception of the Mississippi River (receptor R6). The Mississippi River, which is located at a distance of approximately 5 km from the facility, was included in the ERA screening evaluation to evaluate the potential risk to the pallid sturgeon, in response to the USEPA Region 5 Roadmap for the GECC facility.

The estimated soil, sediment, and surface water concentrations for each of the HAPs and the air concentrations for carbon monoxide were compared to ecological benchmarks. Only two HAPs, methyl mercury and mercuric chloride, exceeded the chemical-specific ecological benchmarks. Estimated concentrations of methyl mercury in sediment in Horseshoe Lake at receptor location 7 (R7) and soil at receptor locations R1 through R5 (conservatively collocated with air maxima) exceed ecological benchmarks. Estimated concentrations of mercuric chloride in soil at receptor locations R1 through R5 (conservatively collocated with air maxima) also exceed ecological benchmarks. A limited number of other HAPs and CO did not have ecological benchmarks; however, through a qualitative evaluation, the ERA screening evaluation determined that these HAPs and CO are unlikely to pose a risk to the federally listed receptors.

The maximum methyl mercury concentration in soil at receptor locations R1 through R5 and in sediment in Horseshoe Lake (R7) were further evaluated to determine the potential risk to the federally listed receptor species (decurrent false aster, pallid sturgeon, bald eagle, least interior tern, gray bat, and Indiana bat). The qualitative evaluation of the decurrent false aster determined that the estimated concentrations of methyl mercury in soil at receptor locations R1 through R5 and the estimated sediment concentration in Horseshoe Lake are unlikely to pose a risk to the plant. The EPA Region 5 benchmark for methyl mercury used for comparison with estimated methyl mercury concentrations is based upon toxicity to the masked shrew and the methyl mercury sediment concentration is below the ORNL plant benchmark for total mercury. Additionally, receptor locations R1 through R5 were conservatively collocated with air maxima locations assuming that the ecological receptor is exposed to the soil at the receptor location continually for 30 years.

The qualitative evaluation of the pallid sturgeon determined that the pallid sturgeon is not at risk from methyl mercury, since the pallid sturgeon is unlikely to be exposed to the maximum

estimated concentrations in Horseshoe Lake (R7) where the pallid sturgeon is unlikely to be present. The estimated concentration of methyl mercury in the Mississippi River (R6), where the pallid sturgeon may be present, was below the ecological benchmark.

The maximum mercuric chloride concentration in soil at receptor locations R1 through R5 was further evaluated to determine the potential risk to the federally listed receptor species. The qualitative evaluation of the decurrent false aster determined that the estimated concentrations of mercuric chloride in soil at receptor locations R1 through R5 are unlikely to pose risk to the plant since the EPA Region 5 benchmark for mercuric chloride used for comparison with estimated mercuric chloride concentrations, is based upon toxicity to the masked shrew. Additionally, receptor locations R1 through R5 were conservatively collocated with air maxima locations assuming that the ecological receptor is exposed to the soil at the receptor location continually for 30 years.

HQs were calculated for the quantitative evaluation of risk for the avian and mammalian receptors potentially exposed to methyl mercury in sediment and surface water. Soil exposure was not applicable to the receptors in the quantitative evaluation for the upper trophic level birds and mammals in this ERA (bald eagle, least interior tern, gray bat, and the Indiana bat). All NOAEL- and LOAEL-based HQs were below 1, indicating that the avian and mammalian federally listed species (i.e., bald eagle, least interior tern, gray bat, and Indiana bat) were not at risk from methyl mercury.

The results of this ERA screening evaluation indicate that the proposed construction of the GECC is unlikely to directly or indirectly adversely affect the federally listed species potentially present in the surrounding area.

1.0 Introduction

The objective of this ecological risk assessment (ERA) screening evaluation was to determine whether the proposed construction of the Gateway Energy and Coke Company (GECC) adja*cent to United States Steel's Granite City Works (GCW) in Granite City, Illinois, is likely to directly or indirectly adversely affect federally listed (i.e., endangered and threatened) species potentially present in the surrounding area. On August 24, 2006, U.S. Environmental Protection Agency (USEPA) Region 5 issued the ***Recommended Scope of Analysis for Endangered Species*** for GECC, referenced as "Roadmap" from this point forward. GECC developed a ***Protocol for Endangered Species Analysis*** (URS Corporation [URS], 2007) in response to the Roadmap. USEPA approved the ***Protocol for Endangered Species Analysis*** (URS, 2007) with comments that are addressed in this ERA, which is performed in accordance with the approved protocol.

The area surrounding the facilities consists of industrial/residential areas as well as ecological habitats such as creeks, large water bodies (e.g., Horseshoe Lake and the Mississippi River), river floodplains, wetlands, and greenspace areas (see Figure 1-1). The ERA screening evaluation was performed for receptor points set at both modeled air maxima locations and identified ecological habitats located within a 3 kilometer (km) radius of GECC and US Steel's GCW, with the exception of the Mississippi River (see Figure 1-2). The Mississippi River, which is located at a distance of approximately 5 km from the facility, was included in the ERA screening evaluation to evaluate the potential risk to the pallid sturgeon (*Scaphirhynchus albus*), in response to the USEPA Region 5 Roadmap for the GECC facility.

1.1 Background

GECC proposes to construct a heat recovery coke making facility adjacent to United States Steel's GCW in Granite City, Illinois. Construction of the heat recovery coke plant will be accompanied by several other improvements at GCW that will result in emission reduction of several air pollutants. $PM_{10}/PM_{2.5}$ is the only pollutant that will have a significant[1] net emissions increase from these projects. There will be minor increases of other air pollutants.

As discussed in the ***Protocol for Endangered Species Analysis*** (URS, 2007), this ERA screening evaluation used the USEPA's draft ***Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*** (SLERAP) (USEPA, 1999) as a general guidance for conducting the evaluation at the request of USEPA Region 5 in the Roadmap for the GECC facility. The air, soil, sediment, and surface water concentrations for each of the hazardous air pollutants (HAPs) were estimated using the Industrial Risk Assessment Program

[1] As defined by Prevention of Significant Deterioration and Nonattainment New Source Review regulations.

for Human Health (IRAP-h View) model, with the exception of carbon monoxide. Carbon monoxide air concentrations were estimated using AERMOD. The estimated media concentrations were used in the ERA screening evaluation. The types of impacts that were considered in this ERA screening evaluation included:

- Direct effects to listed plants and animals exposed to the estimated media concentrations; and
- Indirect effects to animals from ingestion of plants, fish and invertebrates that have accumulated HAPs.

The proposed operation will consist of 120 heat recovery coke ovens in three batteries. Operations at the facility will include coal handling and processing, coal storage, charging, heat recovery coking, pushing, quenching, coke handling and processing, and coke storage. Heat recovery steam generators (HRSGs) will recover waste heat from the ovens to produce steam and electricity. At design capacity, the facility will coke 1.1 million tons coal/year and produce up to 740,000 tons furnace coke/year. A nominal 75 megawatts of electricity will be produced from the waste heat.

The improvements at GCW will include shutdown of several boilers, installing low-NOx burners in the slab furnaces, replacing a large gas-driven pump, and installing a coke oven gas desulfurization system to remove sulfur from the coke oven gas from the existing byproduct coke plant. The coke oven gas is burned in several locations at GCW (e.g., slab furnaces). The resulting emissions increases and decreases from the heat recovery coke plant and other improvements are shown in Table 1-1.

1.2 Report Organization

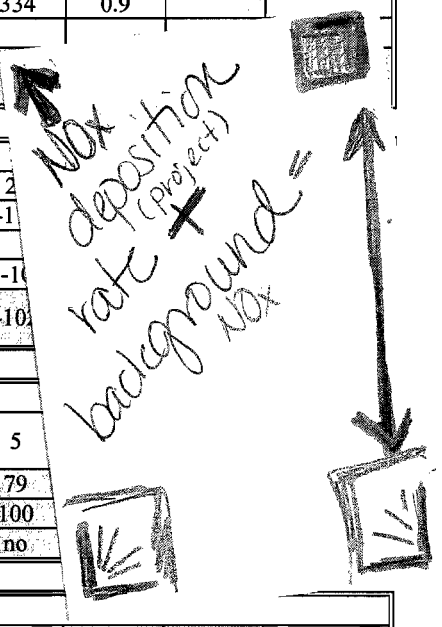
This document contains eight (8) sections:

- Section 1, Introduction, provides a brief summary of the ERA and provides background on the facility;
- Section 2, Constituents of Potential Concern and Emission Rates, presents the emission rate values considered in the ERA for the HAPs and CO;
- Section 3, Air Dispersion and Deposition Modeling, describes the air dispersion and deposition modeling utilized in the ERA;
- Section 4, Problem Formulation, discusses the goal, breadth, and focus of the ERA screening evaluation;
- Section 5, Risk Characterization, presents the results of this ERA screening evaluation;

- Section 6, Uncertainty, presents the uncertainties in this ERA;
- Section 7, Summary of Ecological Risk Assessment Screening Evaluation, summarizes the ERA screening evaluation conclusions; and
- Section 8, References.

Table 1-1. GECC and Related Projects

		Emissions Inventory (tons/year)							
		PM	PM10	SO2	NOx	CO	VOM	Lead	H2SO4
A. Coke Expansion									
1	Heat Recovery Coke Plant (GECC)	326	267	1,406	577	155	38	0.2	31
2	New Coke Conveyance System	0.10	0.05						
	Net Emissions for Heat Recovery Battery Project	326	267	1,406	577	155	38	0.2	31
B. Boiler 1-10 Replacement Project									
3	Shutdown (1-10) Boiler	-189	-189	-350	-279	-314	-1.2		
4	BFG Boiler and New Flare	227	227	445	124	334	0.9		
5	Cogeneration Cooling Tower	2	2						
	Net Emissions for Boiler Replacement Project	41	41	95	-155				
C. US Steel Emission Reduction Projects									
5	Low NOx Burner Slab Furnace	-0.03	-0.03	-0.002	-428	2			
6	#4 COG Booster Replacement	-1	-1	-0.02	-77	-1			
7	COG Desulfurization	-90	-90	-2,722					
8	No. 6 Galvanizing Line shutdown	-1	-1	-0.1	-38	-1			
	Net Emissions for Planned Reductions	-92	-92	-2,722	-544	-10			
D. Other Increases									
9	NG enrichment of CO under-fire system	1	1	0.04	17	5			
	Net emissions change	275	217	-1,220	-104	79			
	Significance Level	25	15	40	40	100			
	Significant Increase (Y/N)	yes	yes	no	no	no			
E. Offsets									
10	Road Sweeping City Streets *	TBD	TBD						



* Planned reductions from road sweeping will at least offset PM and PM_{10} increases.

BFG = Blast furnace gas.
CO = Carbon Monoxide.
COG = Coke Oven Gas.
H_2SO_4 = Sulfuric Acid.
NG = Natural Gas.
NO_x = Nitrogen Oxides.
PM = Particulate matter.
PM_{10} = Particulate matter less than 10 micrometers in diameter.
SO_2 = Sulfur Dioxide.
TBD = To be determined.
TSP = Total Suspended Particulates.
VOM = Volatile Organic Material.

2.0 Constituents of Potential Concern and Emission Rates

As discussed in the ***Protocol for Endangered Species Analysis*** (URS, 2007), this ERA screening evaluation used the resulting emissions from the proposed GECC facility and several GCW projects. As shown in Table 1-1, there will be increases of particulate matter (PM), particulate matter smaller than 10 microns (PM_{10}), carbon monoxide (CO), volatile organic matter (VOM), and lead. Information is available in the database maintained by USEPA, *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (Document AP-42)*, on particulate and vapor phase hazardous air pollutants from heat recovery coke ovens (also called non-recovery coke ovens). This data was used to identify particulate, volatile organic, and other constituents of potential concern. Additional information is available in the GECC application for a construction permit (URS, 2006). To be conservative, the ERA considered all of the HAP emissions and CO from GECC – even though some of these emissions will be offset by the GCW projects.

Table 2-1 lists the potential emission rates of 58 HAPs, benzene-soluble organics (BSO), and CO that were used in the ERA. The polycyclic aromatic hydrocarbon (PAH) speciation of pushing emissions from heat recovery coke making is not known. However, the BSO fraction of PM from pushing emissions was measured at one heat recovery coke plant. Even though the composition of BSO is likely to contain numerous compounds, it was conservatively assumed for the ERA that BSO was 100% benzo(a)pyrene.

Table 2-1. HAPs and CO from Gateway Heat Recovery Coke Plant

Compound	CAS#	Total Emissions (g/sec)
1,1,1-Trichloroethane	71-55-6	4.08E-05
1,1,2,2-Tetrachloroethane	79-34-5	3.26E-05
1,1,2-Trichloroethane	79-00-5	9.46E-06
2-Butanone	78-93-3	1.03E-03
2-Methylphenol (o-cresol)	95-48-7	1.63E-04
4-Methyl-2-Pentanone (methyl isobutyl ketone)	108-10-1	1.45E-04
4-Methylphenol/3-Methylphenol (p-cresol/m-cresol)	106-44-5/108-39-4	5.25E-04
Antimony	7440-36-0	3.03E-04
Arsenic	7440-38-2	4.49E-03
Benzene	71-43-2	8.40E-03
Beryllium	7440-41-7	3.55E-05
Bromoform	75-25-2	1.96E-05
Bromomethane	74-83-9	9.13E-03
BSO		3.31E-03
Cadmium	7440-43-9	2.43E-04
Carbon Disulfide	75-15-0	2.94E-04
Carbon Monoxide [a]	630-08-0	4.45E+00
Chlorobenzene	108-90-7	1.96E-05
Chloroform	67-66-3	1.79E-04
Chloromethane	74-87-3	1.24E-02
Chromium	7440-47-3	8.95E-04
Cobalt [a]	7440-48-4	2.82E-05
Cumene	98-82-8	2.28E-05
Dioxins/furans		
1,2,3,4,6,7,8-HpCDD	35822-46-9	3.50E-10
OCDD	3268-87-9	9.80E-10
1,2,3,4,6,7,8-HpCDF	67562-39-4	3.30E-10
Ethyl Benzene	100-41-4	6.37E-05
Hydrogen chloride	7647-01-0	2.70E+00
Iodomethane (methyl iodide) [a]	74-88-4	1.03E-04
Isooctane (2,2,4-Trimethylpentane) [a]	540-84-1	2.61E-04
Lead	7439-92-1	5.80E-03
Manganese [a]	7439-96-5	9.54E-04
Mercury	7439-97-6	4.34E-03
Methylene Chloride (dichloromethane)	75-09-2	1.08E-02
n-Hexane [a]	110-54-3	2.45E-04
Nickel	7440-02-0	8.49E-04

[a] = Fate and transport parameters are not available for these constituents and, therefore, they were not evaluated in the screening analysis. These constituents are discussed further in the Uncertainty section.

BSO = Benzene-soluble organics.

CO = Carbon monoxide.

Table 2-1. HAPs and CO from Gateway Heat Recovery Coke Plant (Continued)

Compound	CAS#	Total Emissions (g/sec)
PAHs		
Acenapthylene [a]	208-96-8	8.98E-05
Anthracene	120-12-7	3.63E-05
Benzo (a) anthracene	56-55-3	5.65E-06
Benzo (b) fluoranthene	205-99-2	9.75E-06
Benzo (k) fluoranthene	207-08-9	9.26E-06
Benzo (g,h,i) perylene [a]	191-24-2	4.35E-06
Benzo (e) pyrene [a]	50-32-8	1.94E-05
Chrysene	218-01-9	2.38E-05
Fluoranthene	206-44-0	1.21E-04
Fluorene	86-73-7	3.56E-05
Indeno (1,2,3-cd)pyrene	193-39-5	2.49E-06
2-Methylnapthalene [a]	91-57-6	9.15E-05
Naphthalene	91-20-3	4.77E-03
Phenanthrene	85-01-8	1.84E-04
Pyrene	129-00-0	1.29E-05
Phenol	108-95-2	1.54E-03
Phosphorus [a]	7723-14-0	2.01E-02
Selenium	7782-49-2	6.40E-04
Styrene	100-42-5	1.13E-04
Tert-butyl Methyl Ether [a]	1634-04-4	7.67E-07
Toluene	108-88-3	8.59E-03
Trichloroethene	79-01-6	1.42E-04
Vinyl Acetate	108-05-4	1.13E-04
Xylenes	1330-20-7	3.70E-04
Total HAPs plus CO		7.25
Total HAPs w/o CO and HCl		0.10

[a] = Fate and transport parameters are not available for these constituents and, therefore, they were not evaluated in the screening analysis. These constituents are discussed further in the Uncertainty section.

BSO = Benzene-soluble organics.

CO = Carbon monoxide.

3.0 Air Dispersion and Deposition Modeling

GECC has completed a dispersion modeling analysis to assess the potential to affect the ecological community within the vicinity of its planned project in Granite City, Illinois. The modeling was completed per the ***Protocol for Endangered Species Analysis*** (URS, 2007) submitted and approved by the EPA.

The modeling was conducted using the latest version of the USEPA-approved AERMOD (version 07026) model and its attendant preprocessors, AERMET and AERMAP. The modeling used much of the information already supplied by the IEPA as part of its criteria pollutant modeling analysis to assess the likely impact on nearby air quality of the planned GECC project.

Many of the parameters used in the risk analysis were those used in the PM10 analysis.

3.1 Modeling Methodology

The methodology proposed for the assessment of ecological risk to federally listed receptors combined the already completed Prevention of Significant Deterioration (PSD) methods with the ***Final Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*** (HHRAP) guidance (USEPA, 2005a), the companion document to the USEPA Draft SLERAP (USEPA, 1999). For example, the PSD analysis did not include deposition effects, which can be an important component in the assessment of risk, especially to sensitive ecological receptors.

The modeling was conducted using the following components:

- AERMOD version 07026 as the dispersion model;
- 5-years of representative meteorological data from the St. Louis airport;
- A near-source receptor grid conforming with guidance;
- The Building Profile Input Program (BPIP) (version 04274) to determine direction-specific building downwash parameters; and
- Deposition parameters to simulate wet and dry deposition of particular and vapor phase compounds in accordance with guidance.

The use of AERMOD is consistent with the current Guideline on Air Quality Models (GAQM) (40 CFR 51 Appendix W) and reflects the trend in HHRAP assessments as USEPA moves to incorporate AERMOD in the HHRAP guidance.

The meteorological data used included years already used in the GECC PSD modeling analysis and included a five year record (1986-1990) of surface and profile data obtained from the National Weather Service (NWS) St. Louis airport site. The data were processed in AERMET and included site specific geophysical parameters detailed in the GECC PSD application. The meteorological data were processed to include precipitation values to allow direct calculation of wet deposition impacts.

The receptor grid and locations at which concentration and deposition impacts were calculated was based on that data previously used in the PSD modeling and is shown in Figure 3-1. Modeled receptor locations are indicated by blue "dots" and the blue shading in the center of the drawing. As shown, the grid extended approximately 10 km outward from GECC over nearby waterways and parks. Concentration and deposition values were calculated at each of these locations and plotfiles based on these locations were incorporated into the risk assessment calculations.

The direction specific building dimensions determined in support of the GECC PSD application were again used to simulate the potential downwash effects on emitted plumes and subsequent transport downwind.

3.2 Emission Rates and Particle Sizes

Only point sources associated with the GECC facility were modeled, as material handling and fugitive emissions do not include HAPs. To conform to the HHRAP guidance and to account for multiple source emissions the facility modeled emission rate (g/sec) was apportioned amongst the different units to simulate the general release of HAPs from the GECC operations.

The concentration of CO in air was modeled using actual emission rates rather than a unit-emission-rate approach. Emissions of CO occur primarily from the main stack and pushing. As such the actual emissions of CO from the main stack and that from a single representative pushing location were modeled. Deposition values used were consistent with vapor phase modeling approaches as described already in the text. Concentrations of CO in air were calculated for selected receptors and utilized in the screening assessment.

To better represent multiple operating scenarios at Gateway the HAP emissions were apportioned amongst the emitting units based on particulate emission rates. Gateway will need to perform maintenance on its units and to do so will need to divert some of the flue gases through waste heat stacks a few days per year. Because of the maintenance needs, while most of the annual HAP emissions will be emitted from the main stack (approximately 59 percent), the other point sources at Gateway will also contribute. The remaining HAP emissions were modeled as follows: 12 percent from the waste heat stacks, 3 percent from charging, 12 percent

from pushing, and 9 percent from quenching. This results in an aggregate modeled facility surrogate HAP emission rate of about 0.95 g/s. This surrogate rate corresponds to the PM10 emission rates from stacks that also emit HAPS. It is less than the typical unit-emission rate of 1g/s because it corresponds to the distribution of PM10 emissions from stacks that emit HAPs – and excludes material handling and fugitive emission units. The total facility HAP-specific emission rate was then applied to the calculated source specific impact using these surrogate rates to determine HAP-specific ambient concentrations and deposition values. These values were carried forward to the risk calculations.

The Final HHRAP states that "*...a single mean particle size diameter of 1.0 micron may be used to represent all mass in the particle and particle-bound model runs,*" and that "*...use of a 1.0 micron particle size will allow these small particles to be included properly as particles in the risk assessment exposure pathways*" (USEPA, 2005a). Because there is limited information on the size of emissions from the sources at GECC, the conservative assumption was used that particle emissions are 1.0 microns in diameter with a unit density.

The newest version of AERMOD (version 07026) includes a number of parameters to instruct the model on how best to characterize deposition. Some of the parameters define geophysical information while others provide physical properties of emitted material such as that discussed above for size speciation.

The values selected were done so in accordance with the AERMOD User's Guide Addendum and included seasonal and land use information for the area immediately surrounding the facility and that most likely impacted by the facility. Values chosen are consistent with mid-latitude season cycles and the predominantly industrial/residential mix of land use.

Deposition values were selected to conservatively represent physical parameters of emitted constituents. Gas deposition values were selected as appropriate for general gaseous phase constituents. Method_2, was used to simulate particulate deposition and conservatively small values were used in accordance with guidance and to reflect the fact that most of the emitted particulate will be fine with diameters less than 2.5 microns. Values used are summarized in the Table 3-1.

3.3 Modeling and Model Output

As noted above, the modeling results were based on a surrogate facility emission rate apportioned by relative source emission strength. The maximum results from the AERMOD model were used in the calculation of receptor concentrations and deposition values.

The conversion of modeled concentrations to HAP specific values is achieved using the same approach as provided in the HHRAP:

$$\frac{\text{HAP Air Concentration}}{\text{HAP Emission Rate}} = \frac{\text{Modeled Output Air Concentration}}{\text{Unit Emission Rate}}$$

The HAP-specific emission rates were determined by selecting the appropriate emission factor for each HAP.

Through use of the surrogate facility emission rate, the risk appropriate values (e.g., yearly average air concentration from the vapor phase [Cyv - $\mu g\text{-}s/g\text{-}m^3$]) were determined at each receptor location. Pollutant-specific impacts and deposition values were then calculated based on the emission rates discussed.

The maximum values calculated in the modeling based on facility unit-emission-rates are shown in Table 3-2. In accordance with the Final HHRAP (USEPA, 2005a) and SLERAP (USEPA, 1999), the reported annual results represent the average maximum over the five-year period.

Table 3-1. Deposition Parameterizations Used in AERMOD Modeling

Season												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GDSEASON	4	4	3	5	5	1	1	1	2	2	3	4
Landuse												
GDLANUSE	36*6											

Gas Deposition Parameters				
Parameter	**Da (cm^2/s)**	**Dw (cm^2/s)**	**Rcl (s/cm)**	**Henry's Law Constant (Pa m^3/mol)**
GASDEPOS	0.1	1	2.00E+02	2.00E+03

Particle Size Distribution (HHRAP Guidance)		
PARTDIAM	1	
MASSFRAX	1	
Particle Density (HHRAP Guidance)		
PARTDENS	1	

GDSEASON = Seasonal category for gas deposition by month.

GDLANUSE = Land use category.

GASDEPOS = Gas Deposition.

PARTDIAM = Particle diameter.

MASSFRAX = Mass fraction.

PARTDENS = Particle Density.

Table 3-2. Air Maxima Results

Air Parameter	Description	Units	Magnitude of Impact	X (m)	Y (m)
Chv	Unitized hourly maximum air concentration from vapor phase	μg-s/g-m^3	24.26014	749447	4286817
Chp	Unitized hourly maximum air concentration from particle phase	μg-s/g-m^3	24.26014	749447	4286817
Chp-pb	Unitized hourly maximum air concentration from particle-bound phase	μg-s/g-m^3	24.26014	749447	4286817
Cyv	Unitized yearly average air concentration from vapor phase	μg-s/g-m^3	1.78859	749445	4286851
Dywv	Unitized yearly average wet deposition from vapor phase	s/m^2-yr	0.0002	749239	4287035
Dydv	Unitized yearly average dry deposition from vapor phase	s/m^2-yr	0.52669	749400	4286830
Cyp	Unitized yearly average air concentration from particle phase	μg-s/g-m^3	1.78859	749445	4286851
Cyp_pb	Unitized yearly average air concentration from particle-bound phase	μg-s/g-m^3	0.44877	749489	4286872
Dydp	Unitized yearly average dry deposition particle-phase	s/m^2-yr	0.01157	749751	4286973
Dydp_pb	Unitized yearly average dry deposition particle-bound phase	s/m^2-yr	0.13537	749489	4286872
Dywp	Unitized yearly average wet deposition particle phase	s/m^2-yr	0.0002	749239	4287035
Dywp_pb	Unitized yearly average wet deposition particle-bound phase	s/m^2-yr	0.00018	749239	4287035

For air concentration, dry deposition, and wet deposition, the particle and particle-bound values are the same because of the use of a conservative 1 micron diameter classification for all size classes in accordance with 2005 HHRAP guidance and the proximity of the impacts relative to the emission source (USEPA, 2005a).

4.0 Problem Formulation

Problem formulation establishes the goal, breadth, and focus of the ERA screening evaluation. It is a systematic planning step that identifies the major factors, such as the environmental setting, exposure pathways, receptor locations, and the ecological receptors to be considered in the ERA screening evaluation.

4.1 Environmental Setting

Figures 1-1 and 1-2 show the land use and topographical map with receptor locations of the area surrounding GECC, respectively. Receptor locations 1-5 (R1 through R5) are located at the maximum locations of various air parameters (e.g., vapor phase, deposition phase, and particle phase) surrounding the GECC facility developed through site-specific air modeling (see Table 3-2). Table 4-1 presents the receptor locations and descriptions. Receptor location 1 (R1) is located at the dry annual deposition vapor and particle phase maximum location to the south of the main stack on the property boundary. Receptor location 2 (R2) is located at the hourly air concentration vapor, particle, and particle-bound phase maximum location to the southeast of the main stack on the property boundary. Receptor location 3 (R3) is located at the annual air concentration maximum location for particle-bound phase to the northwest of the main stack on the property boundary. Receptor location 4 (R4) is located at the wet annual deposition vapor, particle, and particle-bound phase maximum location to the southeast of the main stack. Receptor location 5 (R5) is located at the annual air concentration maximum for particle and vapor phases to the southeast of the main stack. All of these receptor locations (R1 through R5) are located in the industrial/residential area surrounding the GECC facility and were evaluated for the soil medium only (see Figures 1-1 and 1-2).

Receptor locations 6 and 7 (R6 and R7) were selected for their proximity to the target water bodies (Horseshoe Lake and Mississippi River) and ecological habitat based on professional judgment. Receptor location 6 (R6) is located in close proximity to the Mississippi River to the west of the main stack. Receptor location 7 (R7) is located in close proximity to Horseshoe Lake to the southeast of the main stack. These two receptor locations (R6 and R7) are located in areas offering ecological habitat and were evaluated for the soil, sediment, and surface water media (see Figures 1-1 and 1-2).

4.2 Complete Exposure Pathways

Identifying complete and potentially complete exposure pathways is one of the primary tasks of the screening level ecological characterization of a site. For an exposure to be complete, a constituent that is present at a source of environmental release or one that has migrated from a source of release must be taken up by the ecological receptors via one or more exposure pathways and exposure routes. The conceptual site model (CSM) (Figure 4-1) contains relevant

exposure pathways and routes of exposure for the selected federally listed species evaluated in this ERA screening evaluation (see Section 4.3).

4.3 Federally Listed Receptor Species

An assessment endpoint is an explicit expression of the environmental value that is to be protected (USEPA, 1997). The general assessment endpoint for this ERA screening evaluation is the protection of each of the federally listed species (i.e., individuals) potentially located within the study area from impacts due to exposure of HAP and CO. This analysis was conducted to determine whether modeled (estimated) HAP and CO concentrations in air, soil, sediment, and water caused unacceptable risk to the federally listed receptor species.

The federally listed species evaluated in this ERA screening evaluation included:

- Decurrent false aster (*Boltonia decurrens*);
- Pallid sturgeon (*Scaphirhynchus albus*);
- Bald eagle (*Haliaeetus leucocephalus*);
- Least interior tern (*Sterna antillarum athalassos*);
- Gray bat (*Myotis grisescens*); and
- Indiana bat (*Myotis sodalist*).

4.3.1 Decurrent False Aster

The decurrent false aster (*Boltonia decurrans*) is a federally threatened species found in moist, sandy floodplains and wetlands in areas relatively free of other vegetation. The decurrent false aster is a perennial, living for more than two growing seasons, stands about 1-5 feet (ft) tall, and prefers partial to full sun. The decurrent false aster blooms from July to October with flower heads that are comprised of white "petals" with a yellow center (the "petals" may less commonly be pale violet or pale pink). These flowers attract a variety of insects for pollination including bees, beetles, butterflies, flies, moths, and wasps. Population declines are due to loss of suitable habitat (from conversion of wetlands to agricultural land and excessive silting from agricultural topsoil runoff), the spread of competing vegetation (the decurrent false aster requires periodic flooding to eradicate plants competing for the same habitat), and herbicide application (U.S. Fish and Wildlife Service [USFWS], 1997; Missouri Department of Conservation [MDC], 1997; Hilty, 2007). Plants, such as the decurrent false aster, play a crucial role in supporting the insectivorous bird and herbivorous mammal populations.

4.3.2 Pallid Sturgeon

The pallid sturgeon is a federally endangered species found in portions of the Missouri, Mississippi, and Atchafalaya Rivers and is one of the largest fish found in these rivers. The

pallid sturgeon is a bottom feeder with a toothless mouth on the ventral side of its flattened, elongated snout. It moves along the river bottom sucking up small fish and other small invertebrates (USFWS, 2006a,b). In the upper basin of Montana, the pallid sturgeon was reported to have a mean home range of 9.2 miles (Upper Basin Pallid Sturgeon Workgroup, 2005). The primary cause of the decline of the pallid sturgeon is due to man-caused habitat loss from river impoundments, which destroy the river habitat and block migration routes, uniform channelization of the rivers, and dams, which alter the rivers' temperature and turbidity (USFWS, 2006a,b). The pallid sturgeon, like other fish, interacts in complex ways with the ecosystem and is important in supporting the food chain.

4.3.3 Bald Eagle delisted

The bald eagle (*Haliaeetus leucocephalus*) is a federally threatened species. Population declines of the bald eagle are due to increased reproductive failure from exposure to pesticides and man-caused riparian habitat loss and disturbances (USFWS, 2001). It is a high trophic level carnivorous bird in riparian habitats. Its diet is comprised primarily of fish but as an opportunistic scavenger it also preys upon small mammals, wounded/sick waterfowl, and carrion (Illinois Department of Natural Resources [IDNR] and Illinois Natural History Survey [INHS], 2006). For this ERA screening evaluation, the bald eagle is assumed to have a diet comprised of 80% fish and 10% each of mammals and birds (see Table 4-2). The bald eagle winters along water bodies in the lower 48 states and along the coast of Alaska and Canada, and summers in Canada, Alaska, and scattered locations within the lower 48 states (Cornell Lab of Ornithology [CLO], 2006a). Within Illinois, the bald eagle winters along the Mississippi, Rock, and Illinois Rivers and nests in southern Illinois (IDNR and INHS, 2006); therefore, the bald eagle is possibly present year-round at the site (the ERA screening evaluation assumes a residence time of 100%). Bald eagles build nests in large trees near water bodies and require a large home range; home ranges are known to vary from 1,730 acres to 13.6 million acres (USEPA, 1993; USEPA, 2007b).

The bald eagle's body weight is the average of the mean male and female adult body weights (Dunning, 1993). The food ingestion rate is based upon the allometric equation in the *Wildlife Exposure Factors Handbook* for all birds: kilograms per day (kg/day) = $0.0582*Wt^{0.651}$ (kg) (Equation 3-3 in USEPA, 1993), using the average body weight. The water ingestion rate is based upon the allometric equation for all birds: liters per day (L/day) = $0.059*Wt^{0.57}$ (kg) (Equation 3-15 in USEPA, 1993), using the average body weight. The sediment ingestion rate is based upon the soil ingestion rate of the avian carnivore in the *Ecological Soil Screening Guidance* (USEPA, 2005b) (see Table 4-3).

4.3.4 Least Interior Tern

The least interior tern (*Sterna antillarum anthalassos*) is a federally endangered species. Population declines are due to increased man-caused riparian habitat loss and disturbances, such as the flooding of nesting areas and the recreational use of sandbars (USFWS, 1992a). The least interior tern is a carnivorous migratory shorebird with a diet comprised almost entirely of small fish (see Table 4-2). During breeding season (summer), the least interior tern is found along the Missouri, Ohio, and Mississippi Rivers, nesting on sandbars and traveling 4+ miles from their breeding colonies in search of small fish (CLO, 2006b; UFWS, 1992a). Around early September, the least interior tern migrates south for the winter to Mexico and South America (CLO, 2006b). In Illinois, the interior least tern is present from mid May through early September; however, there is no evidence of nesting within Illinois in over 30 years (IDNR and INHS, 2006). Even though the least interior tern spends no more than a third of the year on site, the ERA screening evaluation conservatively assumes a residence time of 100%.

The least interior tern's body weight is the mean adult body weights (Dunning, 1993). The food ingestion rate is based upon the allometric equation in the *Wildlife Exposure Factors Handbook* for all birds: $kg/day = 0.0582*Wt^{0.651}$ (kg) (Equation 3-3 in USEPA, 1993), using the mean adult body weight. The water ingestion rate is based upon the allometric equation for all birds: $L/day = 0.059*Wt^{0.57}$ (kg) (Equation 3-15 in USEPA, 1993), using the mean adult body weight. The sediment ingestion rate is based upon the soil ingestion rate of the avian carnivore in the *Ecological Soil Screening Guidance* (USEPA, 2005b) (see Table 4-3).

4.3.5 Gray Bat

The gray bat (*Myotis grisescens*) is a federally endangered species. Population declines are due to man-caused disturbances of roosting caves and channelization of streams and rivers. The gray bat is a medium-sized insectivorous bat that feeds on flying insects (e.g., mayflies, midges, moths), primarily mayflies, over water bodies (USFWS, 1992b) (see Table 4-2). Gray bats roost in limestone caves in the southeastern U.S., including south and southwestern Illinois (USFWS, 1992b; USFWS, 1991a). Gray bats migrate between summer (breeding) and winter (hibernation) caves, which may be as little as 10 miles apart or over 200 miles apart, with varying home ranges (USFWS, 1991a; Harriman and Shefferly, 2003). The gray bat is possibly present year-round at the site; therefore, the ERA screening evaluation assumes a residence time of 100%.

The gray bat's body weight is the average of the range of body weights (USFWS, 1991a). The food ingestion rate is based upon the allometric equation in the *Wildlife Exposure Factors Handbook* for all mammals: $kg/day = 0.0687*Wt^{0.822}$ (kg) (Equation 3-7 in USEPA, 1993), using the average body weight. The water ingestion rate is based upon the allometric equation for all mammals: $L/day = 0.099*Wt^{0.90}$ (kg) (Equation 3-17 in USEPA, 1993), using the

average body weight. The sediment ingestion rate is based upon the soil ingestion rate of the mammalian insectivore in the *Ecological Soil Screening Guidance* (USEPA, 2005b) (see Table 4-3).

4.3.6 Indiana Bat

The Indiana bat (*Myotis sodalis*) is a federally endangered species. Population declines are due to man-caused disturbances of roosting caves and channelization of streams and rivers, as well as natural causes such as flooding of winter caves. The Indiana bat is a medium-sized insectivorous bat that feeds on flying insects (e.g., mayflies, midges, moths), primarily over small to medium sized streams (USFWS, 1992c) (see Table 4-2). Indiana bats are distributed across the midwestern and eastern U.S. Indiana bats roost in limestone caves during the winter hibernation and migrate to summer roosting locations such as caves, bridges, old buildings, and hollow trees near streams (USFWS, 1992c; USFWS, 1991b). The adult females and juvenile bats feed over streams, while adult males feed along treetops in floodplain ridges and hillside forests (USFWS, 1991b). Home ranges average range from 128-232 acres (Newell, 1999). The Indiana bat is possibly present year-round at the site ; therefore, the ERA screening evaluation assumes a residence time of 100%.

The Indiana bat's body weight is the average of the range of adult body weights (Newell, 1999). The food ingestion rate is based upon the allometric equation in the *Wildlife Exposure Factors Handbook* for all mammals: $kg/day = 0.0687*Wt^{0.822}$ (kg) (Equation 3-7 in USEPA, 1993), using the average body weight. The water ingestion rate is based upon the allometric equation for all mammals: $L/day = 0.099*Wt^{0.90}$ (kg) (Equation 3-17 in USEPA, 1993), using the average body weight. The sediment ingestion rate is based upon the soil ingestion rate of the mammalian insectivore in the *Ecological Soil Screening Guidance* (USEPA, 2005b) (see Table 4-3).

Table 4-1. Receptor Descriptions and Locations

Receptor Location	Receptor Description	Receptor Location Coordinates		Media Evaluated at the Receptor Location
		X (m)	Y (m)	
R1	Collocated with annual dry deposition for vapor and particle phase air maxima location	749400	4286830	Soil
R2	Collocated with the hourly air concentration for vapor, particle, and particle-bound phase air maxima location	749447	4286818	Soil
R3	Collocated with annual air concentration maxima location for particle-bound phase air maxima location	749489	4286872	Soil
R4	Collocated with annual wet deposition vapor, particle, and particle-bound phase air maxima location	749239	4287035	Soil
R5	Collocated with annual air concentration maxima for particle and vapor phase air maxima location	749445	4286851	Soil
R6	Location selected for proximity to ecological habitat near Mississippi River	751538	4285646	Soil; Surface Water and Sediment from Mississippi River
R7	Location selected for proximity to ecological habitat near Horseshoe Lake	745300	4286105	Soil; Surface Water and Sediment from Horseshoe Lake

Table 4-2. Assumed Dietary Compositions of Avian and Mammalian Receptors

Common Name	Percent of Components in Receptor Diet						Reference
	Riparian Mammals	Riparian Birds	Aquatic/Riparian Vascular Plants	Aquatic/Riparian Insects	Fish	Benthic Invertebrates	
Birds							
Bald Eagle	10	10			80		IDNR and INHS, May 2006.
Least Interior Tern					100		IDNR and INHS, May 2006.
Mammals							
Gray Bat				100			USFWS, 1991a; Harriman and Shefferly, 2003
Indiana Bat				100			USFWS, 1991b; Newell, 1999

IDNR = Illinois Department of Natural Resources.

INHS = Illinois Natural History Survey.

USFWS = United States Fish and Wildlife Service.

Table 4-3. Exposure Assumptions for Avian and Mammalian Receptors

Common Name	Scientific Name	Trophic Guild Representation	Body Weight (kg)	Food Ingestion Rate (kg/day DW)	Water Ingestion Rate (L/day)	Sediment Ingestion (% of Diet)
Birds						
Bald Eagle	*Haliaeetus leucocephalus*	Carnivore	4.740	0.160	0.143	5.7
Least Interior Tern	*Sterna antillarum anthalassos*	Carnivore	0.0431	0.00752	0.00983	5.7
Mammals						
Gray Bat	*Myotis grisescens*	Insectivore	0.0115	0.00175	0.00178	3.0
Indiana Bat	*Myotis sodalis*	Insectivore	0.0085	0.00136	0.00136	3.0

See Section 4.3 for sources.

DW = dry weight.

kg = kilograms.

kg/day = kilograms per day.

L/day = liters per day.

5.0 Risk Characterization

5.1 Constituents of Potential Concern Determination

The first step in the ERA screening evaluation was to use ecological benchmarks to assess ecotoxicity. Ecological benchmarks represent constituent concentrations in air, soil, surface water, and sediment considered to be protective of terrestrial and aquatic receptors, provided that those benchmark values are not exceeded. The ERA used modeled estimated media concentrations for air, soil, surface water and sediment for each HAP and CO at identified receptor locations (see Figure 1-2). Many constituents are ubiquitous and naturally found in various media; therefore, HAP concentrations below background levels are considered to pose no more risk to ecological receptors than the natural environment.

The IRAP-*h* View modeling program, developed by Lakes Environmental in accordance with the Final HHRAP (USEPA, 2005a), was used to simulate movement of compounds through the environment. The IRAP-*h* View model imports air dispersion and deposition modeling data and, using compound-specific stack emission rates and information about the surrounding environment, converts them to media-specific concentrations (e.g., air, soil, surface water, and sediment). The air, soil, sediment, and surface water concentrations for each constituent of potential concern (COPC) were estimated using the IRAP-*h* View model. The estimated media concentrations were then used in the ERA screening evaluation. The types of impacts that were considered in this ERA screening evaluation included:

- Direct effects to listed plants and animals exposed to the estimated media concentrations; and
- Indirect effects to animals from ingestion of plants, fish and invertebrates that have accumulated COPCs.

As described in the ***Protocol for Endangered Species Analysis*** (URS, 2007), the following sources of ecological benchmarks were searched to identify screening values for the HAPs and CO, in the order indicated:

1. The USEPA Region 5, RCRA Ecological Screening Levels (ESLs) (USEPA, 2003) for air, surface water, soil, and sediment benchmarks (see Attachment A);
2. The USEPA Ecological Soil Screening Levels (SSL) for soil benchmarks (http://www.epa.gov/ecotox/ecossl/) (USEPA, 2007a);
3. The USEPA Region 4 Bulletins for surface water, sediment, and soil benchmarks (www.epa.gov/region4/waste/ots/ecolbul.htm) (USEPA, 2001); and

4. The USEPA Region 3 Ecological Screening Benchmarks for surface water and sediment benchmarks (http://www.epa.gov/reg3hwmd/risk/eco/index.htm) (USEPA, 2006);
5. The Illinois Derived Water Quality Criteria (DWQC) for aquatic life for surface water benchmarks (http://www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html) (Illinois Environmental Protection Agency [IEPA], 2006); and
6. The Risk Assessment Information System (RAIS) developed and supported by the Oak Ridge National Laboratory (ORNL) (ORNL, 2006).

As shown in table 5-1 through 5-3, once a screening value was available from one of the aforementioned sources (searched in the order indicated), then further sources were not searched (as indicated by the "—" in the tables). Table 5-1 shows the modeled HAP maximum soil concentrations compared to their soil ecological benchmarks for all receptor locations (R1 through R7). Surface water and sediment were evaluated only at Receptor Locations 6 and 7 (R6 and R7) for the Mississippi River and Horseshoe Lake, respectively. Table 5-2 shows the modeled HAP maximum sediment concentrations compared to their sediment ecological benchmarks, and Table 5-3 shows the modeled HAP maximum surface water concentrations compared to their freshwater ecological benchmarks. Estimated concentrations of carbon monoxide in air were also modeled for evaluation of toxicity potential to the decurrent false aster; however, there are no ecological benchmarks for carbon monoxide. Carbon monoxide is further evaluated in Section 5.2. Constituents with estimated media concentrations (i.e., soil, sediment, surface water) that do not exceed the ecological benchmarks were not evaluated further and were not retained as ecological COPCs.

As shown in Tables 5-1 through 5-3, methyl mercury and mercuric chloride are the only HAPs that exceed the chemical-specific benchmarks. Methyl mercury exceeds in soil at receptor locations R1 through R5 (collocated with air maxima locations) and in sediment at receptor location 7 (R7) in Horseshoe Lake. Mercuric chloride exceeds the chemical-specific benchmark in soil at receptor locations R1 through R5. It must also be noted that ecological benchmarks were not available for a few of the HAPs (see Tables 5-1 through 5-3). A search for background concentrations for methyl mercury in sediment and the chemicals without ecological benchmarks was conducted; however, background concentrations were not available for these chemicals. The HAPs without ecological benchmarks are further discussed in Section 5.2. Methyl mercury and mercuric chloride, which were retained as ecological COPCs in soil (both methyl mercury and mercuric chloride) and sediment (methyl mercury only) are qualitatively evaluated for the false decurrent aster and the pallid sturgeon in Section 5.3. Methyl mercury is quantitatively evaluated for the mammalian and avian receptors in Section 5.4.

5.2 Evaluation of Hazardous Air Pollutants That Lack Ecological Benchmarks

Ecological benchmarks were not available for a limited number of organic HAPs. Ecological benchmarks were not available for hydrogen chloride and cumene in soil; for beryllium and methyl chloride in sediment; for benzo(k)fluoranthene and hydrogen chloride in surface water; and for carbon monoxide in air.

The HAPs without ecological benchmarks are unlikely to pose a risk to the ecological receptors (see Section 4.4). Benzo(k)fluoranthene estimated concentrations in surface water do not exceed the ecological benchmarks for benzo(a)pyrene (a more toxic PAH) (see Table 5-3). Unavailable toxicity data for the remaining HAPS without toxicity data (hydrogen chloride and cumene in soil; beryllium and methyl chloride in sediment; and hydrogen chloride in surface water) may cause underestimation of risk. Additionally, estimated concentrations of carbon monoxide, a criteria pollutant, in air are less than the primary National Ambient Air Quality Standards (NAAQS) and Washington State significant impact levels (SILs) (see Table 5-4) (USEPA, 2007c; Washington State Legislature [WSL], 2007). However, the lack of available ecological benchmarks is likely an indication of their low toxicity potential. Therefore, retention of these HAPs and CO as ecological COPCs is not warranted.

5.3 Qualitative Ecological Screening Evaluation for Methyl Mercury and Mercuric Chloride

The only HAPs that were retained as COPCs due to exceeding the media-specific ecological benchmarks were methyl mercury and mercuric chloride. Estimated concentrations of methyl mercury exceed ecological benchmarks in soil for receptor locations R1 through R5 (conservatively collocated with air maxima locations) and in sediment in Horseshoe Lake for receptor location 7 (R7). Estimated concentrations of mercuric chloride exceed ecological benchmarks in soil at receptor locations R1 through R5 (conservatively collocated with air maxima locations). The following text presents a qualitative evaluation for toxicity potential to the decurrent false aster and the pallid sturgeon.

The decurrent false aster plays an important role in the aquatic/riparian food web as a dietary item for herbivorous and omnivorous mammals and birds, as well as attracting insects for insectivorous birds. The decurrent false aster, which grows in river foodplains and wetlands, is potentially exposed to COPCs through root uptake from riparian soil/sediment and surface water. The USEPA Region 5 ecological benchmark for methyl mercury is based upon toxicity to the masked shrew. When the estimated methyl mercury maximum sediment and soil concentrations (0.0000242 milligrams per kilogram [mg/kg]) and soil concentration of 0.0185 mg/kg are compared to the ORNL plant benchmark for total mercury (0.3 mg/kg), the maximum concentrations are well below the available phytotoxicity benchmark (Efroymson et al., 1997). Therefore, retention of methyl mercury as an ecological COPC for the decurrent false aster is not

warranted. The concentration of mercuric chloride (0.926 mg/kg) is greater than the plant benchmark; however, the bioavailability of mercuric chloride is limited in soil. Mercuric chloride is approximately 15-20% bioavailable (Schoof and Nielsen, 1997), whereas the risk evaluation assumes 100% bioavailability. Retention of mercuric chloride in soil as an ecological COPC for the decurrent false aster is not warranted.

The pallid sturgeon plays an important role in the aquatic food web as a consumer of benthic invertebrates and small fish. The pallid sturgeon is an important prey item for birds and mammals. The pallid sturgeon may be exposed to COPCs through direct contact with water and sediment. Estimated concentrations of methyl mercury in sediment in Horseshoe Lake (receptor location 7 [R7]) exceed the sediment ecological benchmark. Estimated concentrations of methyl mercury, did not exceed the methyl mercury ecological benchmark (see Table 5-2). Since the pallid sturgeon is potentially present in the Mississippi River but unlikely to be found in Horseshoe Lake, retention of methyl mercury as an ecological COPC for the pallid sturgeon is not warranted.

5.4 Quantitative Ecological Screening Evaluation for Methyl Mercury

A trophic level is one of the successive levels of nourishment and energy transfer in a food web or food chain. Birds and mammals are upper tropic-level receptors that ingest lower tropic-level receptors (i.e., plants, invertebrates, and fish) that may have bioaccumulated HAPs in their tissue. Figure 5-1 presents the freshwater aquatic/riparian food web structure, by trophic level, for the federally listed species evaluated in this ERA screening evaluation. The bald eagle, least interior tern, Indiana bat, and gray bat were evaluated to determine if these ecological receptors were at risk from the estimated concentrations of methyl mercury in sediment via incidental ingestion of sediment and ingestion of surface water, plants, fish, and trophic level prey items that may have bioaccumulated methyl mercury in their tissue. Note that soil exposure is not applicable to these receptors.

The estimated concentration of methyl mercury in sediment in Horseshoe Lake (receptor location 7 [R7]) that exceeded the media-specific ecological benchmark was further considered in a risk analysis for upper trophic level receptors. The risk analysis for upper trophic level receptors is a quantitative evaluation of risk whereby Hazard Quotients (HQs) are calculated for sediment. The HQ is calculated by dividing the species-specific daily dose estimate by the toxicity reference value (TRV). The exposure calculation assumed year-round residency for all of the receptor species and that all food was taken from the ecological exposure area exclusively. Attachment B presents the uptake factors (UFs) used, oral toxicity data obtained from the open literature, and the TRVs calculated for each species evaluated. Attachment C presents the risk calculations for avian and mammalian receptors, using the maximum estimated sediment concentration for methyl mercury in Horseshoe Lake (receptor location 7 [R7]). Methyl mercury

in surface water is represented in the exposure calculation, even though it is not a COPC for that medium. Attachment D presents the daily dose equations for the federally listed species evaluated in this ERA screening evaluation. Section 6.0 discusses several uncertainties associated with the calculation of the HQs.

For the ERA screening evaluation, both no observed adverse effects level (NOAEL)-based TRVs and lowest observed adverse effects level (LOAEL)-based TRVs were used in calculating HQs. NOAEL-based HQs above 1 are considered to pose a potential biological risk to the federally listed species. NOAEL-based HQs above 1 but with LOAEL-based HQs below 1 demonstrate that although methyl mercury may result in potential risks above the no effects level, it is not likely to adversely effect ecological receptors. LOAEL-based HQs above 1 would be considered to pose a potential biological risk to the federally listed species.

As shown on Table 5-5, all of the NOAEL- and LOAEL-based HQs are well below 1 for the avian and mammalian federally listed species evaluated in this ERA screening evaluation. Therefore, the estimated methyl mercury concentrations do not pose a risk to the avian and mammalian federally listed species. Retention of methyl mercury as an ecological constituent of concern (COC) for avian and mammalian receptors is not warranted.

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 1 (R1)				
Anthracene	1.15E-03	1.48E+03	--	--
Antimony	2.27E-06	1.42E-01	--	--
Arsenic	7.03E-07	5.70E+00	--	--
Benzene	6.56E-07	2.55E-01	--	--
Benzo(a)anthracene	1.43E-04	5.21E+00	--	--
Benzo(a)pyrene	2.57E-04	1.52E+00	--	--
Benzo(b)fluoranthene	4.03E-04	5.98E+01	--	--
Benzo(k)fluoranthene	4.53E-04	1.48E+02	--	--
Beryllium	7.77E-06	1.06E+00	--	--
Bromoform (Tribromomethane)	8.18E-11	1.59E+01	--	--
BSO [1]	4.39E-02	1.52E+00	--	--
Cadmium	2.44E-06	2.22E-03	--	--
Carbon disulfide	2.75E-09	9.41E-02	--	--
Chlorobenzene	1.02E-08	1.31E+01	--	--
Chloroform (Trichloromethane)	1.19E-08	1.19E+00	--	--
Chromium	2.78E-02	4.00E-01	--	--
Chrysene	1.28E-03	4.73E+00	--	--
Cresol, m-	3.86E-04	3.49E+00	--	--
Cresol, o-	5.37E-05	4.04E+01	--	--
Cresol, p-	2.42E-05	1.63E+02	--	--
Cumene (Isopropylbenzene)	5.60E-08	NA	NA	NA
Ethylbenzene	2.51E-08	5.16E+00	--	--
Fluoranthene	3.69E-03	1.22E+02	--	--
Fluorene	1.48E-04	1.22E+02	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	1.21E-08	1.99E-07	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	1.21E-08	1.99E-07	--	--
Hydrogen chloride	5.84E-01	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 1 (R1) (Continued)				
Indeno(1,2,3-cd)pyrene	1.25E-04	1.09E+02	--	--
Lead	8.67E-04	5.37E-02	--	--
Mercuric chloride [3]	**9.26E-01**	1.00E-01	--	--
Methyl bromide (Bromomethane)	5.80E-07	2.35E-01	--	--
Methyl chloride (Chloromethane)	1.87E-07	1.04E+01	--	--
Methyl ethyl ketone (2-Butanone)	1.97E-05	8.96E+01	--	--
Methyl isobutyl ketone	8.43E-06	4.43E+02	--	--
Methyl mercury	**1.85E-02**	1.58E-03	--	--
Methylene chloride	3.74E-07	4.05E+00	--	--
Naphthalene	8.00E-03	9.94E-02	--	--
Nickel	9.17E-06	1.36E+01	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	3.37E-08	1.99E-07	--	--
Phenanthrene	2.56E-03	4.57E+01	--	--
Phenol	9.63E-04	1.20E+02	--	--
Pyrene	1.68E-03	7.85E+01	--	--
Selenium	1.37E-06	2.76E-02	--	--
Styrene	2.05E-05	4.69E+00	--	--
Tetrachloroethane, 1,1,2,2-	8.18E-08	1.27E-01	--	--
Toluene	1.73E-06	5.45E+00	--	--
Trichloroethane, 1,1,1-	2.17E-09	2.98E+01	--	--
Trichloroethane, 1,1,2-	4.27E-09	2.86E+01	--	--
Trichloroethylene	1.90E-08	1.24E+01	--	--
Vinyl Acetate	6.58E-07	1.27E+01	--	--
Xylene, m- [4]	1.88E-07	1.00E+01	--	--
Xylene, o- [4]	1.91E-07	1.00E+01	--	--
Xylene, p- [4]	1.56E-07	1.00E+01	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 2 (R2)				
Anthracene	9.41E-04	1.48E+03	--	--
Antimony	1.85E-06	1.42E-01	--	--
Arsenic	5.74E-07	5.70E+00	--	--
Benzene	5.36E-07	2.55E-01	--	--
Benzo(a)anthracene	1.24E-04	5.21E+00	--	--
Benzo(a)pyrene	2.35E-04	1.52E+00	--	--
Benzo(b)fluoranthene	3.30E-04	5.98E+01	--	--
Benzo(k)fluoranthene	4.17E-04	1.48E+02	--	--
Beryllium	6.35E-06	1.06E+00	--	--
Bromoform (Tribromomethane)	6.69E-11	1.59E+01	--	--
BSO [1]	4.01E-02	1.52E+00	--	--
Cadmium	2.00E-06	2.22E-03	--	--
Carbon disulfide	2.25E-09	9.41E-02	--	--
Chlorobenzene	8.37E-09	1.31E+01	--	--
Chloroform (Trichloromethane)	9.76E-09	1.19E+00	--	--
Chromium	2.27E-02	4.00E-01	--	--
Chrysene	1.07E-03	4.73E+00	--	--
Cresol, m-	3.16E-04	3.49E+00	--	--
Cresol, o-	4.39E-05	4.04E+01	--	--
Cresol, p-	1.98E-05	1.63E+02	--	--
Cumene (Isopropylbenzene)	4.58E-08	NA	NA	NA
Ethylbenzene	2.06E-08	5.16E+00	--	--
Fluoranthene	3.02E-03	1.22E+02	--	--
Fluorene	1.21E-04	1.22E+02	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	1.58E-08	1.99E-07	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	1.55E-08	1.99E-07	--	--
Hydrogen chloride	4.77E-01	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 2 (R2) (Continued)				
Indeno(1,2,3-cd)pyrene	1.02E-04	1.09E+02	--	--
Lead	7.09E-04	5.37E-02	--	--
Mercuric chloride [3]	**7.65E-01**	1.00E-01	--	--
Methyl bromide (Bromomethane)	4.74E-07	2.35E-01	--	--
Methyl chloride (Chloromethane)	1.53E-07	1.04E+01	--	--
Methyl ethyl ketone (2-Butanone)	1.61E-05	8.96E+01	--	--
Methyl isobutyl ketone	6.89E-06	4.43E+02	--	--
Methyl mercury	**1.53E-02**	1.58E-03	--	--
Methylene chloride	3.06E-07	4.05E+00	--	--
Naphthalene	6.54E-03	9.94E-02	--	--
Nickel	7.50E-06	1.36E+01	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	4.41E-08	1.99E-07	--	--
Phenanthrene	2.09E-03	4.57E+01	--	--
Phenol	7.87E-04	1.20E+02	--	--
Pyrene	1.38E-03	7.85E+01	--	--
Selenium	1.12E-06	2.76E-02	--	--
Styrene	1.68E-05	4.69E+00	--	--
Tetrachloroethane, 1,1,2,2-	6.69E-08	1.27E-01	--	--
Toluene	1.41E-06	5.45E+00	--	--
Trichloroethane, 1,1,1-	1.78E-09	2.98E+01	--	--
Trichloroethane, 1,1,2-	3.49E-09	2.86E+01	--	--
Trichloroethylene	1.56E-08	1.24E+01	--	--
Vinyl Acetate	5.38E-07	1.27E+01	--	--
Xylene, m- [4]	1.54E-07	1.00E+01	--	--
Xylene, o- [4]	1.56E-07	1.00E+01	--	--
Xylene, p- [4]	1.28E-07	1.00E+01	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 3 (R3)				
Anthracene	8.53E-04	1.48E+03	--	--
Antimony	1.68E-06	1.42E-01	--	--
Arsenic	5.21E-07	5.70E+00	--	--
Benzene	4.86E-07	2.55E-01	--	--
Benzo(a)anthracene	1.31E-04	5.21E+00	--	--
Benzo(a)pyrene	2.83E-04	1.52E+00	--	--
Benzo(b)fluoranthene	3.01E-04	5.98E+01	--	--
Benzo(k)fluoranthene	5.13E-04	1.48E+02	--	--
Beryllium	5.75E-06	1.06E+00	--	--
Bromoform (Tribromomethane)	6.06E-11	1.59E+01	--	--
BSO [1]	4.83E-02	1.52E+00	--	--
Cadmium	1.81E-06	2.22E-03	--	--
Carbon disulfide	2.04E-09	9.41E-02	--	--
Chlorobenzene	7.58E-09	1.31E+01	--	--
Chloroform (Trichloromethane)	8.84E-09	1.19E+00	--	--
Chromium	2.06E-02	4.00E-01	--	--
Chrysene	1.03E-03	4.73E+00	--	--
Cresol, m-	2.86E-04	3.49E+00	--	--
Cresol, o-	3.98E-05	4.04E+01	--	--
Cresol, p-	1.79E-05	1.63E+02	--	--
Cumene (Isopropylbenzene)	4.15E-08	NA	NA	NA
Ethylbenzene	1.86E-08	5.16E+00	--	--
Fluoranthene	2.74E-03	1.22E+02	--	--
Fluorene	1.10E-04	1.22E+02	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	3.14E-08	1.99E-07	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	3.00E-08	1.99E-07	--	--
Hydrogen chloride	4.32E-01	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 3 (R3) (Continued)				
Indeno(1,2,3-cd)pyrene	9.26E-05	1.09E+02	--	--
Lead	6.43E-04	5.37E-02	--	--
Mercuric chloride [3]	**7.16E-01**	1.00E-01	--	--
Methyl bromide (Bromomethane)	4.30E-07	2.35E-01	--	--
Methyl chloride (Chloromethane)	1.39E-07	1.04E+01	--	--
Methyl ethyl ketone (2-Butanone)	1.46E-05	8.96E+01	--	--
Methyl isobutyl ketone	6.24E-06	4.43E+02	--	--
Methyl mercury	**1.43E-02**	1.58E-03	--	--
Methylene chloride	2.77E-07	4.05E+00	--	--
Naphthalene	5.92E-03	9.94E-02	--	--
Nickel	6.79E-06	1.36E+01	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	8.78E-08	1.99E-07	--	--
Phenanthrene	1.89E-03	4.57E+01	--	--
Phenol	7.13E-04	1.20E+02	--	--
Pyrene	1.25E-03	7.85E+01	--	--
Selenium	1.02E-06	2.76E-02	--	--
Styrene	1.52E-05	4.69E+00	--	--
Tetrachloroethane, 1,1,2,2-	6.06E-08	1.27E-01	--	--
Toluene	1.28E-06	5.45E+00	--	--
Trichloroethane, 1,1,1-	1.61E-09	2.98E+01	--	--
Trichloroethane, 1,1,2-	3.16E-09	2.86E+01	--	--
Trichloroethylene	1.41E-08	1.24E+01	--	--
Vinyl Acetate	4.87E-07	1.27E+01	--	--
Xylene, m- [4]	1.39E-07	1.00E+01	--	--
Xylene, o- [4]	1.42E-07	1.00E+01	--	--
Xylene, p- [4]	1.16E-07	1.00E+01	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 4 (R4)				
Anthracene	4.84E-04	1.48E+03	--	--
Antimony	9.52E-07	1.42E-01	--	--
Arsenic	2.95E-07	5.70E+00	--	--
Benzene	2.76E-07	2.55E-01	--	--
Benzo(a)anthracene	6.50E-05	5.21E+00	--	--
Benzo(a)pyrene	1.26E-04	1.52E+00	--	--
Benzo(b)fluoranthene	1.70E-04	5.98E+01	--	--
Benzo(k)fluoranthene	2.24E-04	1.48E+02	--	--
Beryllium	3.26E-06	1.06E+00	--	--
Bromoform (Tribromomethane)	3.44E-11	1.59E+01	--	--
BSO [1]	2.15E-02	1.52E+00	--	--
Cadmium	1.03E-06	2.22E-03	--	--
Carbon disulfide	1.16E-09	9.41E-02	--	--
Chlorobenzene	4.30E-09	1.31E+01	--	--
Chloroform (Trichloromethane)	5.02E-09	1.19E+00	--	--
Chromium	1.17E-02	4.00E-01	--	--
Chrysene	5.55E-04	4.73E+00	--	--
Cresol, m-	1.62E-04	3.49E+00	--	--
Cresol, o-	2.26E-05	4.04E+01	--	--
Cresol, p-	1.02E-05	1.63E+02	--	--
Cumene (Isopropylbenzene)	2.35E-08	NA	NA	NA
Ethylbenzene	1.06E-08	5.16E+00	--	--
Fluoranthene	1.55E-03	1.22E+02	--	--
Fluorene	6.22E-05	1.22E+02	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	9.39E-09	1.99E-07	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	9.12E-09	1.99E-07	--	--
Hydrogen chloride	2.45E-01	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 4 (R4) (Continued)				
Indeno(1,2,3-cd)pyrene	5.25E-05	1.09E+02	--	--
Lead	3.65E-04	5.37E-02	--	--
Mercuric chloride [3]	**3.95E-01**	1.00E-01	--	--
Methyl bromide (Bromomethane)	2.44E-07	2.35E-01	--	--
Methyl chloride (Chloromethane)	7.86E-08	1.04E+01	--	--
Methyl ethyl ketone (2-Butanone)	8.30E-06	8.96E+01	--	--
Methyl isobutyl ketone	3.54E-06	4.43E+02	--	--
Methyl mercury	**7.87E-03**	1.58E-03	--	--
Methylene chloride	1.57E-07	4.05E+00	--	--
Naphthalene	3.36E-03	9.94E-02	--	--
Nickel	3.85E-06	1.36E+01	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	2.62E-08	1.99E-07	--	--
Phenanthrene	1.07E-03	4.57E+01	--	--
Phenol	4.05E-04	1.20E+02	--	--
Pyrene	7.08E-04	7.85E+01	--	--
Selenium	5.76E-07	2.76E-02	--	--
Styrene	8.64E-06	4.69E+00	--	--
Tetrachloroethane, 1,1,2,2-	3.44E-08	1.27E-01	--	--
Toluene	7.26E-07	5.45E+00	--	--
Trichloroethane, 1,1,1-	9.12E-10	2.98E+01	--	--
Trichloroethane, 1,1,2-	1.79E-09	2.86E+01	--	--
Trichloroethylene	8.00E-09	1.24E+01	--	--
Vinyl Acetate	2.77E-07	1.27E+01	--	--
Xylene, m- [4]	7.90E-08	1.00E+01	--	--
Xylene, o- [4]	8.04E-08	1.00E+01	--	--
Xylene, p- [4]	6.57E-08	1.00E+01	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 5 (R5)				
Anthracene	1.12E-03	1.48E+03	--	--
Antimony	2.21E-06	1.42E-01	--	--
Arsenic	6.84E-07	5.70E+00	--	--
Benzene	6.39E-07	2.55E-01	--	--
Benzo(a)anthracene	1.52E-04	5.21E+00	--	--
Benzo(a)pyrene	2.97E-04	1.52E+00	--	--
Benzo(b)fluoranthene	3.94E-04	5.98E+01	--	--
Benzo(k)fluoranthene	5.30E-04	1.48E+02	--	--
Beryllium	7.56E-06	1.06E+00	--	--
Bromoform (Tribromomethane)	7.96E-11	1.59E+01	--	--
BSO [1]	5.07E-02	1.52E+00	--	--
Cadmium	2.38E-06	2.22E-03	--	--
Carbon disulfide	2.68E-09	9.41E-02	--	--
Chlorobenzene	9.96E-09	1.31E+01	--	--
Chloroform (Trichloromethane)	1.16E-08	1.19E+00	--	--
Chromium	2.70E-02	4.00E-01	--	--
Chrysene	1.29E-03	4.73E+00	--	--
Cresol, m-	3.76E-04	3.49E+00	--	--
Cresol, o-	5.23E-05	4.04E+01	--	--
Cresol, p-	2.36E-05	1.63E+02	--	--
Cumene (Isopropylbenzene)	5.45E-08	NA	NA	NA
Ethylbenzene	2.45E-08	5.16E+00	--	--
Fluoranthene	3.60E-03	1.22E+02	--	--
Fluorene	1.44E-04	1.22E+02	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	2.30E-08	1.99E-07	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	2.23E-08	1.99E-07	--	--
Hydrogen chloride	5.68E-01	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 5 (R5) (Continued)				
Indeno(1,2,3-cd)pyrene	1.22E-04	1.09E+02	--	--
Lead	8.45E-04	5.37E-02	--	--
Mercuric chloride [3]	**9.16E-01**	1.00E-01	--	--
Methyl bromide (Bromomethane)	5.65E-07	2.35E-01	--	--
Methyl chloride (Chloromethane)	1.82E-07	1.04E+01	--	--
Methyl ethyl ketone (2-Butanone)	1.92E-05	8.96E+01	--	--
Methyl isobutyl ketone	8.21E-06	4.43E+02	--	--
Methyl mercury	**1.83E-02**	1.58E-03	--	--
Methylene chloride	3.64E-07	4.05E+00	--	--
Naphthalene	7.79E-03	9.94E-02	--	--
Nickel	8.93E-06	1.36E+01	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	6.43E-08	1.99E-07	--	--
Phenanthrene	2.49E-03	4.57E+01	--	--
Phenol	9.37E-04	1.20E+02	--	--
Pyrene	1.64E-03	7.85E+01	--	--
Selenium	1.33E-06	2.76E-02	--	--
Styrene	2.00E-05	4.69E+00	--	--
Tetrachloroethane, 1,1,2,2-	7.97E-08	1.27E-01	--	--
Toluene	1.68E-06	5.45E+00	--	--
Trichloroethane, 1,1,1-	2.11E-09	2.98E+01	--	--
Trichloroethane, 1,1,2-	4.16E-09	2.86E+01	--	--
Trichloroethylene	1.85E-08	1.24E+01	--	--
Vinyl Acetate	6.41E-07	1.27E+01	--	--
Xylene, m- [4]	1.83E-07	1.00E+01	--	--
Xylene, o- [4]	1.86E-07	1.00E+01	--	--
Xylene, p- [4]	1.52E-07	1.00E+01	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 6 (R6)				
Anthracene	1.72E-05	1.48E+03	--	--
Antimony	3.38E-08	1.42E-01	--	--
Arsenic	1.05E-08	5.70E+00	--	--
Benzene	9.79E-09	2.55E-01	--	--
Benzo(a)anthracene	3.62E-06	5.21E+00	--	--
Benzo(a)pyrene	9.22E-06	1.52E+00	--	--
Benzo(b)fluoranthene	6.17E-06	5.98E+01	--	--
Benzo(k)fluoranthene	1.70E-05	1.48E+02	--	--
Beryllium	1.16E-07	1.06E+00	--	--
Bromoform (Tribromomethane)	1.22E-12	1.59E+01	--	--
BSO [1]	1.57E-03	1.52E+00	--	--
Cadmium	3.64E-08	2.22E-03	--	--
Carbon disulfide	4.10E-11	9.41E-02	--	--
Chlorobenzene	1.53E-10	1.31E+01	--	--
Chloroform (Trichloromethane)	1.78E-10	1.19E+00	--	--
Chromium	4.14E-04	4.00E-01	--	--
Chrysene	2.37E-05	4.73E+00	--	--
Cresol, m-	5.77E-06	3.49E+00	--	--
Cresol, o-	7.86E-07	4.04E+01	--	--
Cresol, p-	3.61E-07	1.63E+02	--	--
Cumene (Isopropylbenzene)	8.36E-10	NA	NA	NA
Ethylbenzene	3.75E-10	5.16E+00	--	--
Fluoranthene	5.54E-05	1.22E+02	--	--
Fluorene	2.21E-06	1.22E+02	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	1.48E-09	1.99E-07	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	1.40E-09	1.99E-07	--	--
Hydrogen chloride	8.71E-03	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 6 (R6) (Continued)				
Indeno(1,2,3-cd)pyrene	1.86E-06	1.09E+02	--	--
Lead	1.29E-05	5.37E-02	--	--
Mercuric chloride [3]	1.55E-02	1.00E-01	--	--
Methyl bromide (Bromomethane)	8.65E-09	2.35E-01	--	--
Methyl chloride (Chloromethane)	2.79E-09	1.04E+01	--	--
Methyl ethyl ketone (2-Butanone)	2.95E-07	8.96E+01	--	--
Methyl isobutyl ketone	1.26E-07	4.43E+02	--	--
Methyl mercury	3.10E-04	1.58E-03	--	--
Methylene chloride	5.58E-09	4.05E+00	--	--
Naphthalene	1.19E-04	9.94E-02	--	--
Nickel	1.37E-07	1.36E+01	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	4.15E-09	1.99E-07	--	--
Phenanthrene	3.82E-05	4.57E+01	--	--
Phenol	1.44E-05	1.20E+02	--	--
Pyrene	2.52E-05	7.85E+01	--	--
Selenium	2.04E-08	2.76E-02	--	--
Styrene	3.07E-07	4.69E+00	--	--
Tetrachloroethane, 1,1,2,2-	1.22E-09	1.27E-01	--	--
Toluene	2.58E-08	5.45E+00	--	--
Trichloroethane, 1,1,1-	3.24E-11	2.98E+01	--	--
Trichloroethane, 1,1,2-	6.37E-11	2.86E+01	--	--
Trichloroethylene	2.84E-10	1.24E+01	--	--
Vinyl Acetate	9.82E-09	1.27E+01	--	--
Xylene, m- [4]	2.80E-09	1.00E+01	--	--
Xylene, o- [4]	2.86E-09	1.00E+01	--	--
Xylene, p- [4]	2.33E-09	1.00E+01	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 7 (R7)				
Anthracene	3.17E-06	1.48E+03	--	--
Antimony	6.24E-09	1.42E-01	--	--
Arsenic	1.93E-09	5.70E+00	--	--
Benzene	1.81E-09	2.55E-01	--	--
Benzo(a)anthracene	6.69E-07	5.21E+00	--	--
Benzo(a)pyrene	1.71E-06	1.52E+00	--	--
Benzo(b)fluoranthene	1.14E-06	5.98E+01	--	--
Benzo(k)fluoranthene	3.15E-06	1.48E+02	--	--
Beryllium	2.14E-08	1.06E+00	--	--
Bromoform (Tribromomethane)	2.25E-13	1.59E+01	--	--
BSO [1]	2.91E-04	1.52E+00	--	--
Cadmium	6.72E-09	2.22E-03	--	--
Carbon disulfide	7.57E-12	9.41E-02	--	--
Chlorobenzene	2.82E-11	1.31E+01	--	--
Chloroform (Trichloromethane)	3.28E-11	1.19E+00	--	--
Chromium	7.64E-05	4.00E-01	--	--
Chrysene	4.38E-06	4.73E+00	--	--
Cresol, m-	1.06E-06	3.49E+00	--	--
Cresol, o-	1.45E-07	4.04E+01	--	--
Cresol, p-	6.67E-08	1.63E+02	--	--
Cumene (Isopropylbenzene)	1.54E-10	NA	NA	NA
Ethylbenzene	6.92E-11	5.16E+00	--	--
Fluoranthene	1.02E-05	1.22E+02	--	--
Fluorene	4.07E-07	1.22E+02	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	2.74E-10	1.99E-07	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	2.59E-10	1.99E-07	--	--
Hydrogen chloride	1.61E-03	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-1. Soil HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Soil Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 7 (R7) (Continued)				
Indeno(1,2,3-cd)pyrene	3.44E-07	1.09E+02	--	--
Lead	2.39E-06	5.37E-02	--	--
Mercuric chloride [3]	2.87E-03	1.00E-01	--	--
Methyl bromide (Bromomethane)	1.60E-09	2.35E-01	--	--
Methyl chloride (Chloromethane)	5.15E-10	1.04E+01	--	--
Methyl ethyl ketone (2-Butanone)	5.43E-08	8.96E+01	--	--
Methyl isobutyl ketone	2.32E-08	4.43E+02	--	--
Methyl mercury	5.72E-05	1.58E-03	--	--
Methylene chloride	1.03E-09	4.05E+00	--	--
Naphthalene	2.20E-05	9.94E-02	--	--
Nickel	2.52E-08	1.36E+01	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	7.69E-10	1.99E-07	--	--
Phenanthrene	7.04E-06	4.57E+01	--	--
Phenol	2.65E-06	1.20E+02	--	--
Pyrene	4.65E-06	7.85E+01	--	--
Selenium	3.77E-09	2.76E-02	--	--
Styrene	5.65E-08	4.69E+00	--	--
Tetrachloroethane, 1,1,2,2-	2.25E-10	1.27E-01	--	--
Toluene	4.75E-09	5.45E+00	--	--
Trichloroethane, 1,1,1-	5.98E-12	2.98E+01	--	--
Trichloroethane, 1,1,2-	1.18E-11	2.86E+01	--	--
Trichloroethylene	5.24E-11	1.24E+01	--	--
Vinyl Acetate	1.81E-09	1.27E+01	--	--
Xylene, m- [4]	5.17E-10	1.00E+01	--	--
Xylene, o- [4]	5.27E-10	1.00E+01	--	--
Xylene, p- [4]	4.30E-10	1.00E+01	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-2. Sediment HAP Concentrations and Ecological Benchmarks

HAP	Maximum Sediment Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	USEPA Region 3 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 6 (R6)					
Anthracene	8.76E-10	5.72E-02	--	--	--
Antimony	7.60E-12	--	1.20E+01	2.00E+00	
Arsenic	1.44E-14	9.79E+00	--	--	--
Benzene	4.97E-11	1.42E-01	--	--	--
Benzo(a)anthracene	1.01E-09	1.08E-01	--	--	--
Benzo(a)pyrene	4.79E-09	1.50E-01	--	--	--
Benzo(b)fluoranthene	6.89E-09	1.04E+01	--	--	--
Benzo(k)fluoranthene	2.16E-09	2.40E-01	--	--	--
Beryllium	2.32E-13	NA	NA	NA	NA
Bromoform (Tribromomethane)	2.23E-16	4.92E-01	--	--	--
BSO [1]	8.17E-07	1.50E-01	--	--	--
Cadmium	7.40E-14	9.90E-01	--	--	--
Carbon disulfide	3.70E-13	2.39E-02	--	--	--
Chlorobenzene	5.75E-13	2.91E-01	--	--	--
Chloroform (Trichloromethane)	1.30E-12	1.21E-01	--	--	--
Chromium [5]	0.00E+00	4.34E+01	--	--	--
Chrysene	6.12E-09	1.66E-01	--	--	--
Cresol, m-	5.20E-11	5.24E-02	--	--	--
Cresol, o-	1.55E-11	5.54E-02	--	--	--
Cresol, p-	4.54E-11	2.02E-02	--	--	--
Cumene (Isopropylbenzene)	9.64E-15	--	--	8.60E-02	--
Ethylbenzene	8.09E-13	1.75E-01	--	--	--
Fluoranthene	6.59E-09	4.23E-01	--	--	--
Fluorene	2.85E-10	7.74E-02	--	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	3.17E-15	1.20E-07	--	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	8.79E-15	1.20E-07	--	--	--
Hydrogen chloride [5]	0.00E+00	NA	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

[5] The Final HHRAP database does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. This HAP is further discussed in the Uncertainty section.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-2. Sediment HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Sediment Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	USEPA Region 3 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 6 (R6) (Continued)					
Indeno(1,2,3-cd)pyrene	2.12E-11	2.00E-01	--	--	--
Lead	2.04E-11	3.58E+01	--	--	--
Mercuric chloride [3]	1.45E-06	1.74E-01	--	--	--
Methyl bromide (Bromomethane)	7.64E-12	1.37E-03	--	--	--
Methyl chloride (Chloromethane)	3.50E-12	NA	NA	NA	NA
Methyl ethyl ketone (2-Butanone)	2.17E-12	4.24E-02	--	--	--
Methyl isobutyl ketone	1.97E-12	2.51E-02	--	--	--
Methyl mercury	1.19E-08	1.00E-05	--	--	--
Methylene chloride	2.46E-11	1.59E-01	--	--	--
Naphthalene	3.17E-09	1.76E-01	--	--	--
Nickel	2.77E-13	2.27E+01	--	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	6.07E-15	1.20E-07	--	--	--
Phenanthrene	5.42E-09	2.04E-01	--	--	--
Phenol	5.42E-11	4.91E-02	--	--	--
Pyrene	9.78E-10	1.95E-01	--	--	--
Selenium [5]	0.00E+00	--	--	2.00E+00	--
Styrene	1.72E-11	2.54E-01	--	--	--
Tetrachloroethane, 1,1,2,2-	1.71E-12	8.50E-01	--	--	--
Toluene	9.24E-11	1.22E+00	--	--	--
Trichloroethane, 1,1,1-	1.73E-13	2.13E-01	--	--	--
Trichloroethane, 1,1,2-	2.82E-13	5.18E-01	--	--	--
Trichloroethylene	7.11E-13	1.12E-01	--	--	--
Vinyl Acetate	3.36E-13	1.30E-02	--	--	--
Xylene, m- [4]	4.87E-12	4.33E-01	--	--	--
Xylene, o- [4]	9.08E-12	4.33E-01	--	--	--
Xylene, p- [4]	7.59E-12	4.33E-01	--	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

[5] The Final HHRAP database does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. This HAP is further discussed in the Uncertainty section.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-2. Sediment HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Sediment Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	USEPA Region 3 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 7 (R7)					
Anthracene	2.80E-07	5.72E-02	--	--	--
Antimony	3.20E-10	--	1.20E+01	2.00E+00	--
Arsenic	5.95E-13	9.79E+00	--	--	--
Benzene	2.17E-09	1.42E-01	--	--	--
Benzo(a)anthracene	2.68E-07	1.08E-01	--	--	--
Benzo(a)pyrene	5.84E-07	1.50E-01	--	--	--
Benzo(b)fluoranthene	6.62E-07	1.04E+01	--	--	--
Benzo(k)fluoranthene	2.59E-07	2.40E-01	--	--	--
Beryllium	9.87E-12	NA	NA	NA	NA
Bromoform (Tribromomethane)	8.92E-15	4.92E-01	--	--	--
BSO [1]	9.97E-05	1.50E-01	--	--	--
Cadmium	3.10E-12	9.90E-01	--	--	--
Carbon disulfide	1.52E-11	2.39E-02	--	--	--
Chlorobenzene	2.78E-11	2.91E-01	--	--	--
Chloroform (Trichloromethane)	5.96E-11	1.21E-01	--	--	--
Chromium [5]	0.00E+00	4.34E+01	--	--	--
Chrysene	8.92E-07	1.66E-01	--	--	--
Cresol, m-	5.77E-07	5.24E-02	--	--	--
Cresol, o-	1.45E-07	5.54E-02	--	--	--
Cresol, p-	5.26E-07	2.02E-02	--	--	--
Cumene (Isopropylbenzene)	4.55E-13	--	--	8.60E-02	--
Ethylbenzene	3.86E-11	1.75E-01	--	--	--
Fluoranthene	4.93E-06	4.23E-01	--	--	--
Fluorene	9.66E-08	7.74E-02	--	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	1.08E-13	1.20E-07	--	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	3.40E-13	1.20E-07	--	--	--
Hydrogen chloride [5]	0.00E+00	NA	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

[5] The Final HHRAP database does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. This HAP is further discussed in the Uncertainty section.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-2. Sediment HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Sediment Concentration (mg/kg)	USEPA Region 5 ESL (mg/kg)	USEPA Region 4 ESL (mg/kg)	USEPA Region 3 ESL (mg/kg)	RAIS (mg/kg)
Receptor Location 7 (R7) (Continued)					
Indeno(1,2,3-cd)pyrene	1.28E-09	2.00E-01	--	--	--
Lead	8.58E-10	3.58E+01	--	--	--
Mercuric chloride [3]	1.55E-04	1.74E-01	--	--	--
Methyl bromide (Bromomethane)	3.09E-10	1.37E-03	--	--	--
Methyl chloride (Chloromethane)	1.80E-10	NA	NA	NA	NA
Methyl ethyl ketone (2-Butanone)	8.50E-10	4.24E-02	--	--	--
Methyl isobutyl ketone	3.68E-10	2.51E-02	--	--	--
Methyl mercury	**2.42E-05**	1.00E-05	--	--	--
Methylene chloride	1.15E-09	1.59E-01	--	--	--
Naphthalene	2.77E-07	1.76E-01	--	--	--
Nickel	1.17E-11	2.27E+01	--	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	2.02E-13	1.20E-07	--	--	--
Phenanthrene	3.82E-06	2.04E-01	--	--	--
Phenol	8.18E-07	4.91E-02	--	--	--
Pyrene	7.48E-07	1.95E-01	--	--	--
Selenium [5]	0.00E+00	--	--	2.00E+00	--
Styrene	8.96E-10	2.54E-01	--	--	--
Tetrachloroethane, 1,1,2,2-	1.77E-10	8.50E-01	--	--	--
Toluene	4.28E-09	1.22E+00	--	--	--
Trichloroethane, 1,1,1-	7.61E-12	2.13E-01	--	--	--
Trichloroethane, 1,1,2-	1.83E-11	5.18E-01	--	--	--
Trichloroethylene	3.14E-11	1.12E-01	--	--	--
Vinyl Acetate	2.73E-11	1.30E-02	--	--	--
Xylene, m- [4]	2.33E-10	4.33E-01	--	--	--
Xylene, o- [4]	4.02E-10	4.33E-01	--	--	--
Xylene, p- [4]	3.51E-10	4.33E-01	--	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

[5] The Final HHRAP database does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. This HAP is further discussed in the Uncertainty section.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-3. Surface Water HAP Concentrations and Ecological Benchmarks

HAP	Maximum Water Concentration (mg/L)	USEPA Region 5 ESL (mg/L)	USEPA Region 4 ESL (mg/L)	USEPA Region 3 ESL (mg/L)	IEPA DWQC (mg/L)	RAIS (mg/L)
Receptor Location 6 (R6)						
Anthracene	9.32E-13	3.50E-05	--	--	--	--
Antimony	1.69E-13	8.00E-02	--	--	--	--
Arsenic	4.97E-16	1.48E-01	--	--	--	--
Benzene	2.01E-11	1.14E-01	--	--	--	--
Benzo(a)anthracene	7.04E-14	2.50E-05	--	--	--	--
Benzo(a)pyrene	1.24E-13	1.40E-05	--	--	--	--
Benzo(b)fluoranthene	1.64E-13	9.07E-03	--	--	--	--
Benzo(k)fluoranthene	5.45E-14	NA	NA	NA	NA	NA
Beryllium	2.93E-16	3.60E-03	--	--	--	--
Bromoform (Tribromomethane)	4.43E-17	2.30E-01	--	--	--	--
BSO [1]	2.11E-11	1.40E-05	--	--	--	--
Cadmium	9.87E-16	1.50E-04	--	--	--	--
Carbon disulfide	1.40E-13	1.50E-02	--	--	--	--
Chlorobenzene	6.41E-14	4.70E-02	--	--	--	--
Chloroform (Trichloromethane)	6.18E-13	1.40E-01	--	--	--	--
Chromium [5]	0.00E+00	4.20E-02	--	--	--	--
Chrysene	3.81E-13	NA	NA	NA	NA	7.00E-03
Cresol, m-	1.54E-11	6.20E-02	--	--	--	--
Cresol, o-	4.69E-12	6.70E-02	--	--	--	--
Cresol, p-	1.54E-11	2.50E-02	--	--	--	--
Cumene (Isopropylbenzene)	2.36E-16	NA	NA	2.60E-03	--	--
Ethylbenzene	9.91E-14	1.40E-02	--	--	--	--
Fluoranthene	3.36E-12	1.90E-03	--	--	--	--
Fluorene	9.23E-13	1.90E-02	--	--	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	1.28E-21	3.00E-12	--	--	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	1.42E-20	3.00E-12	--	--	--	--
Hydrogen chloride	1.37E-08	NA	NA	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

[5] The Final HHRAP database does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. This HAP is further discussed in the Uncertainty section.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-3. Surface Water HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Water Concentration (mg/L)	USEPA Region 5 ESL (mg/L)	USEPA Region 4 ESL (mg/L)	USEPA Region 3 ESL (mg/L)	IEPA DWQC (mg/L)	RAIS (mg/L)
Receptor Location 6 (R6) (Continued)						
Indeno(1,2,3-cd)pyrene	1.72E-16	4.31E-03	--	--	--	--
Lead	2.26E-14	1.17E-03	--	--	--	--
Mercuric chloride [3]	2.47E-11	1.30E-06	--	--	--	--
Methyl bromide (Bromomethane)	2.12E-11	1.60E-02	--	--	--	--
Methyl chloride (Chloromethane)	1.40E-11	NA	5.50E+00	--	--	--
Methyl ethyl ketone (2-Butanone)	2.71E-11	2.20E+00	--	--	--	--
Methyl isobutyl ketone	3.23E-12	1.70E-01	--	--	--	--
Methyl mercury	4.36E-12	2.46E-06	--	--	--	--
Methylene chloride	6.14E-11	9.40E-01	--	--	--	--
Naphthalene	6.65E-11	1.30E-02	--	--	--	--
Nickel	4.26E-15	2.89E-02	--	--	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	1.55E-21	3.00E-12	--	--	--	--
Phenanthrene	5.11E-12	3.60E-03	--	--	--	--
Phenol	4.52E-11	1.80E-01	--	--	--	--
Pyrene	3.60E-13	3.00E-04	--	--	--	--
Selenium [5]	0.00E+00	5.00E-03	--	--	--	--
Styrene	4.71E-13	3.20E-02	--	--	--	--
Tetrachloroethane, 1,1,2,2-	5.43E-13	3.80E-01	--	--	--	--
Toluene	1.65E-11	2.53E-01	--	--	--	--
Trichloroethane, 1,1,1-	3.20E-14	7.60E-02	--	--	--	--
Trichloroethane, 1,1,2-	9.41E-14	5.00E-01	--	--	--	--
Trichloroethylene	1.88E-13	4.70E-02	--	--	--	--
Vinyl Acetate	1.60E-12	2.48E-01	--	--	--	--
Xylene, m- [4]	6.21E-13	2.70E-02	--	--	--	--
Xylene, o- [4]	9.42E-13	2.70E-02	--	--	--	--
Xylene, p- [4]	6.10E-13	2.70E-02	--	--	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

[5] The Final HHRAP database does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. This HAP is further discussed in the Uncertainty section.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-3. Surface Water HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Water Concentration (mg/L)	USEPA Region 5 ESL (mg/L)	USEPA Region 4 ESL (mg/L)	USEPA Region 3 ESL (mg/L)	IEPA DWQC (mg/L)	RAIS (mg/L)
Receptor Location 7 (R7)						
Anthracene	2.98E-10	3.50E-05	--	--	--	--
Antimony	7.11E-12	8.00E-02	--	--	--	--
Arsenic	2.05E-14	1.48E-01	--	--	--	--
Benzene	8.80E-10	1.14E-01	--	--	--	--
Benzo(a)anthracene	1.87E-11	2.50E-05	--	--	--	--
Benzo(a)pyrene	1.51E-11	1.40E-05	--	--	--	--
Benzo(b)fluoranthene	1.58E-11	9.07E-03	--	--	--	--
Benzo(k)fluoranthene	6.53E-12	NA	NA	NA	NA	NA
Beryllium	1.25E-14	3.60E-03	--	--	--	--
Bromoform (Tribromomethane)	1.77E-15	2.30E-01	--	--	--	--
BSO [1]	2.57E-09	1.40E-05	--	--	--	--
Cadmium	4.14E-14	1.50E-04	--	--	--	--
Carbon disulfide	5.75E-12	1.50E-02	--	--	--	--
Chlorobenzene	3.11E-12	4.70E-02	--	--	--	--
Chloroform (Trichloromethane)	2.84E-11	1.40E-01	--	--	--	--
Chromium [5]	0.00E+00	4.20E-02	--	--	--	--
Chrysene	5.56E-11	NA	NA	NA	NA	7.00E-03
Cresol, m-	1.71E-07	6.20E-02	--	--	--	--
Cresol, o-	4.39E-08	6.70E-02	--	--	--	--
Cresol, p-	1.78E-07	2.50E-02	--	--	--	--
Cumene (Isopropylbenzene)	1.12E-14	NA	NA	2.60E-03	--	--
Ethylbenzene	4.73E-12	1.40E-02	--	--	--	--
Fluoranthene	2.51E-09	1.90E-03	--	--	--	--
Fluorene	3.13E-10	1.90E-02	--	--	--	--
HeptaCDD, 1,2,3,4,6,7,8- [2]	4.40E-20	3.00E-12	--	--	--	--
HeptaCDF, 1,2,3,4,6,7,8- [2]	5.48E-19	3.00E-12	--	--	--	--
Hydrogen chloride	6.71E-07	NA	NA	NA	NA	NA

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

[5] The Final HHRAP database does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. This HAP is further discussed in the Uncertainty section.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-3. Surface Water HAP Concentrations and Ecological Benchmarks (Continued)

HAP	Maximum Water Concentration (mg/L)	USEPA Region 5 ESL (mg/L)	USEPA Region 4 ESL (mg/L)	USEPA Region 3 ESL (mg/L)	IEPA DWQC (mg/L)	RAIS (mg/L)
Receptor Location 7 (R7) (Continued)						
Indeno(1,2,3-cd)pyrene	1.04E-14	4.31E-03	--	--	--	--
Lead	9.53E-13	1.17E-03	--	--	--	--
Mercuric chloride [3]	2.63E-09	1.30E-06	--	--	--	--
Methyl bromide (Bromomethane)	8.59E-10	1.60E-02	--	--	--	--
Methyl chloride (Chloromethane)	7.19E-10	NA	5.50E+00	--	--	--
Methyl ethyl ketone (2-Butanone)	1.06E-08	2.20E+00	--	--	--	--
Methyl isobutyl ketone	6.04E-10	1.70E-01	--	--	--	--
Methyl mercury	4.64E-10	2.46E-06	--	--	--	--
Methylene chloride	2.88E-09	9.40E-01	--	--	--	--
Naphthalene	5.82E-09	1.30E-02	--	--	--	--
Nickel	1.79E-13	2.89E-02	--	--	--	--
OctaCDD, 1,2,3,4,6,7,8,9- [2]	5.18E-20	3.00E-12	--	--	--	--
Phenanthrene	3.60E-09	3.60E-03	--	--	--	--
Phenol	6.81E-07	1.80E-01	--	--	--	--
Pyrene	2.75E-10	3.00E-04	--	--	--	--
Selenium [5]	0.00E+00	5.00E-03	--	--	--	--
Styrene	2.46E-11	3.20E-02	--	--	--	--
Tetrachloroethane, 1,1,2,2-	5.61E-11	3.80E-01	--	--	--	--
Toluene	7.64E-10	2.53E-01	--	--	--	--
Trichloroethane, 1,1,1-	1.41E-12	7.60E-02	--	--	--	--
Trichloroethane, 1,1,2-	6.09E-12	5.00E-01	--	--	--	--
Trichloroethylene	8.33E-12	4.70E-02	--	--	--	--
Vinyl Acetate	1.30E-10	2.48E-01	--	--	--	--
Xylene, m- [4]	2.97E-11	2.70E-02	--	--	--	--
Xylene, o- [4]	4.17E-11	2.70E-02	--	--	--	--
Xylene, p- [4]	2.59E-11	2.70E-02	--	--	--	--

[1] The ecological benchmark for benzo(a)pyrene was used.

[2] The ecological benchmark for 2,3,7,8-TCDD was used.

[3] The ecological benchmark for mercury (total) was used.

[4] The ecological benchmark for xylenes (total) was used.

[5] The Final HHRAP database does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. This HAP is further discussed in the Uncertainty section.

-- = Screening benchmark available, source not searched.

Bold = Exceeds ecological benchmark.

BSO = Benzene-soluble organics.

ESL = Ecological Screening Levels

HAP = Hazardous Air Pollutant.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

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USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 5-4. Carbon Monoxide Air Concentrations and Air Quality Benchmarks

Receptor Location	1-HR Concentration [1] (mg/m^3)	Annual Concentration [2] (mg/m^3)	1-HR SIL (mg/m^3)	8-HR SIL (mg/m^3)	1-HR NAAQS (mg/m^3)	8-HR NAAQS (mg/m^3)
R1	1.74E-01	1.21E-01	2.00E+00	5.00E-01	4.00E+01	1.00E+01
R2	1.53E-01	8.38E-02	2.00E+00	5.00E-01	4.00E+01	1.00E+01
R3	9.12E-02	5.21E-02	2.00E+00	5.00E-01	4.00E+01	1.00E+01
R4	7.96E-02	3.72E-02	2.00E+00	5.00E-01	4.00E+01	1.00E+01
R5	1.38E-01	8.46E-02	2.00E+00	5.00E-01	4.00E+01	1.00E+01
R6	2.09E-03	1.29E-03	2.00E+00	5.00E-01	4.00E+01	1.00E+01
R7	1.72E-03	6.63E-04	2.00E+00	5.00E-01	4.00E+01	1.00E+01

[1] The 1-hour concentrations were compared to the 1-hour SIL and 1-hour NAAQs.

[2] The annual concentrations were compared to the 8-hour SIL and 8-hour NAAQs.

Bold = Exceeds ecological benchmark.

mg/m^3 = milligrams per cubic meter.

HR = Hour.

NAAQS = National Ambient Air Quality Standards, the values used are for primary standards (USEPA, 2007c).

SIL = Significant Impact Level, per WAC 173-400-113 (WSL, April 2007).

Table 5-5. Summary of Oral Hazard Quotients for Methyl Mercury at Receptor Location 7 (R7)

COPC	Bald Eagle		Least Interior Tern		Gray Bat		Indiana Bat	
	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ
Methyl mercury	2.3E-05	4.7E-06	1.4E-02	2.9E-03	2.5E-01	5.1E-02	2.7E-01	5.4E-02

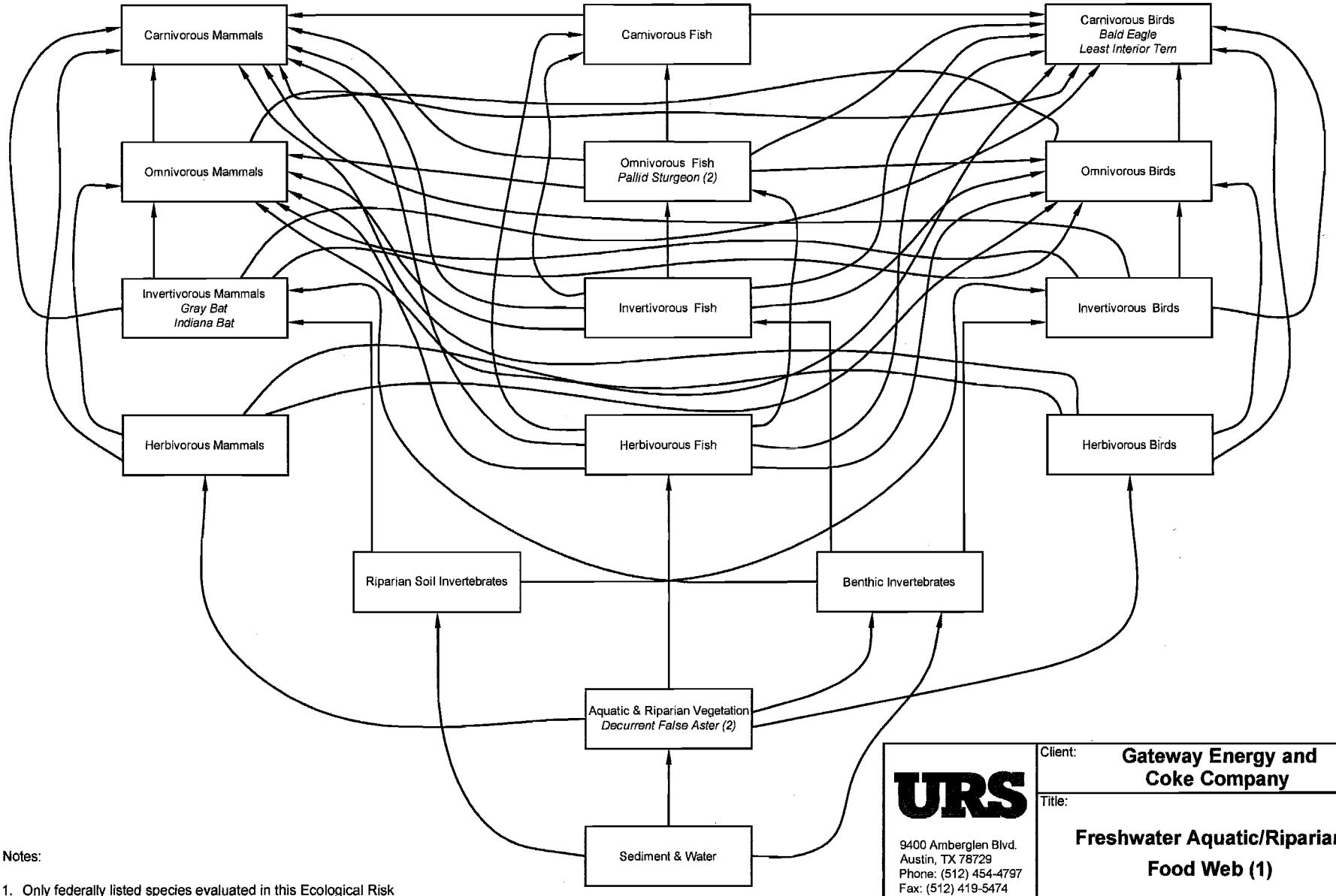
Bold = HQ greater than one.

COPC = Constituent of potential concern.

HQ = Hazard quotient.

LOAEL = Lowest observed adverse effects level.

NOAEL = No observed adverse effects level.



Notes:

1. Only federally listed species evaluated in this Ecological Risk Assessment (ERA) screening evaluation (ESA) are shown.
2. Ecological risk to the pallid sturgeon and decurrent false aster were evaluated qualitatively.

URS
9400 Amberglen Blvd.
Austin, TX 78729
Phone: (512) 454-4797
Fax: (512) 419-5474

Client: **Gateway Energy and Coke Company**

Title: **Freshwater Aquatic/Riparian Food Web (1)**

Drawn by:	Date:	Drawing File:	Figure:
		Flow_Charts.dwg	5-1

6.0 Uncertainty Analysis

Uncertainty and the relative degree of such uncertainty should be considered when interpreting the results of the ERA screening evaluation. Uncertainties are associated with each step in the evaluation, including HAP estimations, problem formulation, and risk characterization. Sources of uncertainty for this ERA screening evaluation are discussed below.

6.1 Hazardous Air Pollutant Emission Rates

The emission rate used for estimating methyl mercury concentrations for use in the screening assessment is conservative. The emission rate was based on an uncontrolled emission factor with a worst case removal of 20% in the air pollution control system (spray dryer and fabric filter). The system will actually include a powdered activated carbon injection system designed to remove 90% of the mercury from the main stack.

6.2 Modeling of Hazardous Air Pollutant Concentrations in Soil, Surface Water and Sediment

Air dispersion and deposition modeling and hundreds of individual calculations were performed to model the transport and fate of constituents emitted from the heat recovery coke plant. Transport and fate calculations included estimation of:

- Soil concentrations resulting from deposition; and
- Surface water concentrations resulting from deposition and surface runoff;

Modeling the environmental transport and fate of constituents requires the use of simplifying assumptions to simulate the environment. In reality, the migration, dispersion, and degradation of constituents in various environmental media involve many complex processes that are not always accurately addressed in models. However, assumptions made in the modeling process are intended to be conservative.

Ecological receptor locations R1 through R5 were conservatively collocated with the modeled air maxima locations. Additionally, the fate and transport modeling, which was performed in accordance with the Final HHRAP (USEPA, 2005a), assumes that the time over which deposition occurs is assumed to be 30 years. Therefore, the ecological receptors are assumed to be exposed to COPCs at the receptor location for 30 years, which is a conservative assumption.

Uncertainties Associated with Transport and Fate Modeling

Fate and transport values were not available for all HAPs in the HHRAP database (USEPA, 2005a). Those COPCs for which fate and transport values were not provided in the

HHRAP database were not included for estimation of media concentrations for the ERA. Table 6-1 presents a list of those COPCs not included in the evaluation. Therefore, risk to ecological receptors from facility emission may be underestimated for these COPCs. All other constituents for which emission rates were determined were evaluated in the ERA.

Table 6-1. Constituents Not Evaluated in the Risk Assessment Due to Limited or Lack of Fate and Transport or Toxicity Values

2-Methylnapthalene
Acenaphthylene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Carbon monoxide *
Cobalt
Iodomethane (methyl iodide)
Isooctane (2,2,4-Trimethylpentane)
Manganese
n-Hexane
Phosphorus
Tert-butyl Methyl Ether

* Air concentrations for carbon monoxide were estimated utilizing AERMOD and were compared to ecological screening levels.

Modeling of Hydrogen Chloride in Sediment

There are no sediment concentrations for hydrogen chloride because the HHRAP database (USEPA, 2005a) does not have all of the necessary fate and transport properties to calculate sediment concentrations for this HAP. In the case of chlorine and hydrogen chloride a value of 0 is used for the following:

Kd_sw = suspended sediment-surface water partition coefficient (L/kg)

Kd_bs = bottom sediment-sediment pore water partition coefficient (cm^3/g)

Hydrogen chloride is a gas that is highly soluble in water and does not bind to sediment. Therefore, the estimated concentrations of zero in the sediment for this constituent would be expected and does not lead to any uncertainty in this ERA.

Modeling of Chromium and Selenium in Surface Water and Sediment

There are no estimated surface water and sediment concentrations for chromium and selenium because the HHRAP database (USEPA, 2005a) does not have all of the necessary fate and transport properties to calculate surface water and sediment concentrations for these HAPs. In the case of chromium and selenium, a value of 0 is used for the following:

ksg = COPC soil loss constant due to biotic and abiotic degradation (yr^{-1})

Soil degradation rates were not available for chromium and selenium. Based on this, USEPA recommends utilizing a value of zero to account for this lack of data and estimated concentrations in surface water and sediment of zero are expected.

6.3 Toxicity Data Selection

TRVs were not available to evaluate the toxicity of methyl mercury for the mammalian and avian federally listed species evaluated in this ERA screening evaluations; however, both mammalian and avian methyl mercury TRVs were available for other mammalian and avian species. An attempt was made to identify studies using species within the same guild. The rat was used as the surrogate for the bats and the mallard was used as the surrogate for the birds. Species respond differently to exposures to toxicants. Responses to HAP exposure by the species used in this evaluation may be different from species for which toxicity data were reported. Direction and magnitude of this uncertainty are not measurable, although the choice of conservative TRVs when multiple studies were available tends to skew the evaluation toward more protective conclusions (see Section 6.4).

6.4 Conservatism of Toxicity Reference Values

As presented in the ***Protocol for Endangered Species Analysis*** (URS, 2007), this ERA screening evaluation selected mammal and avian methyl mercury toxicity studies, which are used for the development of TRVs, based on several key factors including, preference for chronic (i.e., long-term) endpoints, especially those that include critical life stages; preference for a conservative NOAEL; preference for food studies over gavage or oral intubation studies (intraperitoneal or intravenous studies were not used for ingestion based TRVs); preference of life stages of gestation/development, then post-natal, juvenile, and adult; and preferences for endpoint responses to toxicity of growth, development, reproduction, or mortality. These preferences should be considered to be conservative.

An uncertainty factor in the calculation the final avian TRV was the use of a LOAEL to determine a NOAEL by multiplying the chronic LOAEL by an uncertainty factor of 5. However, the calculated NOAEL was less than (more conservative) the other chronic NOAEL studies found in the literature search.

The combination of these factors results in the development of conservative TRVs, which were then used to calculate the HQs and assess the potential risk to the receptors from exposure to methyl mercury (see Attachment B).

6.5 Lack of Ecological Benchmarks

Ecological benchmarks were not available for a limited number of organic HAPs and CO. Ecological benchmarks were not available for hydrogen chloride and cumene in soil; for beryllium and methyl chloride in sediment; for benzo(k)fluoranthene and hydrogen chloride in surface water; and for carbon monoxide in air.

Carbon monoxide air concentrations were estimated to determine the risk, if any, they pose to the decurrent false aster. Carbon monoxide is believed to not be phytotoxic (National Park Services [NPS], 2007). The USEPA set NAAQS (40 CFR part 50) for human health and environmental air pollutants as part of the Clean Air Act (USEPA, 2007c). There are two types of NAAQS, primary standards that protect the health of "sensitive" human populations (e.g., the elderly, children, and asthmatics) and secondary standards that protect the general human population and the environment. Secondary standards for carbon monoxide were promulgated in 1971 but revoked in 1980 because no adverse effects had been reported at ambient air concentrations (secondary standards); therefore, there are currently only primary standards for carbon monoxide. As shown on Table 5-4, none of the estimated carbon monoxide concentrations exceed the primary NAAQS. In addition, Washington State developed SILs for carbon monoxide, none of which were exceeded by the corresponding estimated hourly rate concentrations (see Table 5-4) (WSL, 2007). Based on this weight-of-evidence analysis, retention of carbon monoxide as a COPC is not warranted.

If the ecological benchmark for benzo(a)pyrene (a much more toxic PAH) is compared to the benzo(k)fluoranthene estimated concentrations in surface water, then none exceed, indicating that it is unlikely that the concentrations of benzo(k)fluoranthene pose a threat to ecological receptors (see Table 5-3). Unavailable toxicity data for the remaining HAPs without toxicity data (hydrogen chloride and cumene in soil; beryllium and methyl chloride in sediment; and hydrogen chloride in surface water) may cause underestimation of risk. However, the lack of available ecological benchmarks is likely an indication of their low toxicity potential.

6.6 Selection of Uptake Factors for Mammalian and Avian Receptors

An UF is a fraction of the contaminant concentration from a given media (e.g., sediment) that is taken up by a receptor. Chemical-specific uptake factors were used in the calculation of HQs for methyl mercury exposure to the federally listed species (see Attachment B). In the calculation of the total daily dose for the gray bat and Indiana bat, UFs for benthic invertebrates were utilized as the UFs for the flying insects ingested by the bats, not aquatic insect UFs (see Attachment D). This was done because the UFs for aquatic insects are supposed to be multiplied by water concentrations, not sediment concentrations for which the benthic invertebrate UFs are meant, and because UFs for flying insects are not available. The use of benthic invertebrate UFs

may lead to a level of uncertainty in the risk calculation (HQ). The direction and magnitude of this uncertainty is not measurable.

6.7 Assumed Dietary Compositions of Avian Receptors

The assumed dietary composition of the bald eagle was 80% fish, 10% small mammals, and 10% birds and 100% fish for the least interior tern. In order to calculate the total daily dose for the fish portion of the diet, the fish UF was multiplied by the percent diet and the maximum estimated concentration of methyl mercury in water, not sediment, since the fish UF is based upon water exposure (see Attachment D). To calculate the mammal and bird food portions of the total daily dose for the bald eagle, the UFs for mammals and birds were multiplied by the estimated maximum sediment methyl mercury concentration (see Attachment D). Therefore, methyl mercury sediment exposure was only evaluated for these avian receptors via the incidental ingestion of sediment and 20% of the total daily dose for the bald eagle. This is an acceptable level of uncertainty in this ERA screening evaluation because the HQs reflect the actual exposure expected of these avian receptors, which primarily eat fish.

6.8 Simultaneous Exposure to Multiple Constituents

Another source of uncertainty originated from the use of toxicity values reported in the open literature that were derived from single-species, single-constituent laboratory studies. Prediction of ecosystem effects from laboratory studies is difficult. Laboratory studies cannot take into account the effects of environmental factors that may add to the effects of chemical stress. Without exception, methyl mercury TRVs were selected from studies using single-constituent exposure scenarios. The endpoint species selected to represent the wildlife expected to occur within the exposure area were exposed to a variety of constituents, and it is not known whether the individual constituents in this mixture are synergistic, additive, or antagonistic. Therefore, the magnitude of this uncertainty is not measurable and this could increase or decrease risk.

6.9 Area Use Factors

To conduct the ERA screening evaluation conservatively, the assumption is made that all wildlife receptors obtained 100% of their dietary needs from within a 3-5 km radius of the facility (i.e., area use factors were not applied). However, this assumption overestimates the percentage of the diet obtained from the area for the receptors with home ranges greater than this area (6,983-19,398 acres).

The home range of an animal is simply the area that an animal uses during its normal daily activities; primarily foraging, but also finding shelter, mating, etc., as opposed to a territory, which is defended and is generally smaller than a home range. An area use factor

(AUF) defines the ratio of site area to a receptor's home range. When the home range is larger than the site area, then an AUF can be calculated.

As presented in Section 4.3, the home ranges of the avian and mammalian receptors can vary. In the upper basin of Montana, the pallid sturgeon was reported to have a mean home range of 9.2 miles (Upper Basin Pallid Sturgeon Workgroup, 2005). The bald eagle has home ranges ranging from 1,730 acres to 13.6 million acres (USEPA, 2007b). The least tern travels 4+ miles from their breeding colonies in search of small fish with equates to a potential home range of approximately 8,000 acres (UFWS, 1992a). The gray bats home range varies but is likely similar to the home range of the Indiana bat, which ranges from 128 – 232 acres.

The Mississippi River, which is located at a distance of approximately 5 km from the facility, was included in the ERA screening evaluation to evaluate the potential risk to the pallid sturgeon, in response to the USEPA Region 5 Roadmap for the GECC facility. However, the majority of the pallid sturgeon home range of 9.2 acres falls outside of the 5 km radius, thus likely overestimating risk to the pallid sturgeon. The home ranges of the rest of the receptors fall within the area of the assessment and therefore the assumption of 100% diet gathered from within the 3-5 km radius of the facility does not overestimate the potential for risk to these species based on area use only.

6.10 Seasonal Use Factors

Review of an authoritative source of migratory habits of Illinois birds (IDNR and INHS, 2006) shows that the least interior tern is migratory in Illinois and would be expected to be in the area only four months of the year. Accounting for seasonal migration habits of least interior tern would influence the degree of risk associated with exposure of this receptor

6.11 Use of Available Benchmarks

The ecological benchmark represents a constituent concentration in a given media that is considered to be protective of the ecological community, provided that the benchmark value is not exceeded. However, the benchmarks used in the initial screening of the ERA screening evaluation were based on the protection of a single species (i.e., the Region 5 benchmark for methyl mercury is based upon protection of the masked shrew). These benchmarks were applied to all of the federally species. This could cause an overestimation of risk for species that do not fall within the guild that the benchmark is based.

7.0 Summary of Ecological Risk Assessment Screening Evaluation

The area surrounding the proposed GECC and GCW facilities consists of industrial/residential areas as well as ecological habitats such as creeks, large water bodies (e.g., Horseshoe Lake and the Mississippi River), river floodplains, wetlands, and greenspace areas. The ERA screening evaluation was performed at identified ecological habitats located within a 3 km radius of GECC and US Steel's GCW (R1-R5 and R7), with the exception of the Mississippi River (R6). The Mississippi River, which is located at a distance of approximately 5 km from the facility, was included in the ERA screening evaluation to evaluate the potential risk to the pallid sturgeon, in response to the USEPA Region 5 Roadmap for the GECC facility.

The soil, sediment, and surface water concentrations for each of the HAPs and the air concentrations for carbon monoxide were estimated as described in Sections 2 and 3. These estimated concentrations were compared to ecological benchmarks. Only two HAPs, methyl mercury and mercury chloride, exceeded the chemical-specific ecological benchmarks. Estimated concentrations of methyl mercury in sediment in Horseshoe Lake at receptor location 7 (R7) and soil at receptor locations R1 through R5 (conservatively collocated with air maxima) exceed ecological benchmarks. Estimated concentrations of mercuric chloride in soil for receptor locations R1 through R5 also exceed ecological benchmarks. A limited number of other HAPs and CO did not have ecological benchmarks; however, through a qualitative evaluation, the ERA screening evaluation determined that these HAPs and CO are unlikely to pose a risk to the federally listed receptors (see Sections 3.2 and 4.4).

The maximum methyl mercury concentration in soil at receptor locations R1 through R5 and in sediment in Horseshoe Lake (R7) were further evaluated to determine the potential risk to the federally listed receptor species (decurrent false aster, pallid sturgeon, bald eagle, least interior tern, gray bat, and Indiana bat). The qualitative evaluation of the decurrent false aster determined that the estimated concentrations of methyl mercury in soil at receptor locations R1 through R5 and the estimated sediment concentration in Horseshoe Lake are unlikely to pose a risk to the plant. The EPA Region 5 benchmark for methyl mercury used for comparison with estimated methyl mercury concentrations is based upon toxicity to the masked shrew and the methyl mercury sediment concentration is below the ORNL plant benchmark for total mercury. Additionally, receptor locations R1 through R5 were conservatively collocated with air maxima locations assuming that the ecological receptor is exposed to the soil at the receptor location continually for 30 years.

The qualitative evaluation of the pallid sturgeon determined that the pallid sturgeon is not at risk from methyl mercury, since the pallid sturgeon is unlikely to be exposed to the maximum estimated concentrations in Horseshoe Lake (R7) where the pallid sturgeon is unlikely to be

present. The estimated concentration of methyl mercury in the Mississippi River (R6), where the pallid sturgeon may be present, was below the ecological benchmark.

The maximum mercuric chloride concentration in soil at receptor locations R1 through R5 was further evaluated to determine the potential risk to the federally listed receptor species. The qualitative evaluation of the decurrent false aster determined that the estimated concentrations of mercuric chloride in soil at receptor locations R1 through R5 are unlikely to pose risk to the plant since the EPA Region 5 benchmark for mercuric chloride used for comparison with estimated mercuric chloride concentrations, is based upon toxicity to the masked shrew. Additionally, receptor locations R1 through R5 were conservatively collocated with air maxima locations assuming that the ecological receptor is exposed to the soil at the receptor location continually for 30 years.

HQs were calculated for the quantitative evaluation of risk for the avian and mammalian receptors potentially exposed to methyl mercury in sediment and surface water. Soil exposure was not applicable to the receptors in the quantitative evaluation for the upper trophic level birds and mammals in this ERA (bald eagle, least interior tern, gray bat, and the Indiana bat). All NOAEL- and LOAEL-based HQs were below 1, indicating that the avian and mammalian federally listed species (i.e., bald eagle, least interior tern, gray bat, and Indiana bat) were not at risk from methyl mercury.

The results of this ERA screening evaluation indicate that the proposed construction of the GECC is unlikely to directly or indirectly adversely affect the federally listed species potentially present in the surrounding area.

8.0 References

Betchtel Jacobs Company, LLC, 1998. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation. U.S. Department of Energy, Office of Environmental Management. BJC/OR-112.

Cornell Lab of Ornithology (CLO), 2006a. *Bald Eagle*. All About Birds. Last accessed on May 3, 2007 at http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Bald_Eagle_dtl.html.

CLO, 2006b. *Least Interior Tern*. All About Birds. Last accessed on May 3, 2007 at http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Least_Tern_dtl.html.

Dunning, J.B., Jr., 1993. *CRC Handbook of Avian Body Masses*. CRC Press, Boca Raton, GL. 371 pp.

Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten, 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. ES/ER/TM-85/R3. Oak Ridge National Laboratory, Oak Ridge, TN.

Harriman, V., and N. Shefferly, 2003. "Myotis grisescens," Animal Diversity Web. Last accessed online May 3, 2007 at http://animaldiversity.ummz.umich.edu/site/accounts/information/Myotis_grisescens.html.

Hilty, John, 2007. *Wetland Wildflowers of Illinois: False Aster*. Last accessed online May 3, 2007 at http://www.illinoiswildflowers.info/wetland/plants/false_aster.htm.

Illinois Department of Natural Resources (IDNR) and Illinois Natural History Survey (INHS), 2006. *Illinois Birds*. Last accessed online May 3, 2006 at http://www.inhs.uiuc.edu/chf/pub/ifwis/birds/index.html.

Illinois Environmental Protection Agency (IEPA), 2006. Derived Water Quality Criteria, Updated June 2006. Website: http://www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html.

Missouri Department of Conservation (MDC), 1997. *Endangered Species Guidesheet: Decurrent False Aster*. Last accessed online November 11, 2006 at http://www.mdc.mo.gov/nathis/endangered/endanger/aster/.

Newell, T., 1999. "Myotis sodalis," Animal Diversity Web. Last accessed online May 3, 2007 at http://www.animaldiversity.ummz.umich.edu/site/accounts/information/Myotis_sodalis.html.

National Parks Service (NPS), 2007. Forest Health and Air Quality. National Park Services, U.S. Department of the Interior. Last accessed online May 9, 2007 at http://home.nps.gov/applications/nature/documents/forest_health_air.pdf.

Oak Ridge National Laboratory (ORNL), 2006. Risk Assessment Information System. Website last updated October, 2006: http://rais.ornl.gov/cgi-bin/eco/ECO_select.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1998. Development and Validation of Bioaccumulation Models for Small Mammals. Prepared for the U.S. Department of Energy, Office of Environmental Management. February 1998. ES/ER/TM-219.

Schoof, R.A., and J. B> Nielsen, 1997. Evaluation of Methods for Assessing the Oral Bioavailability of Inorganic Mercury in Soil. Risk Analysis Vol. 17, No. 5.

Upper Basin Pallid Sturgeon Workgroup, 2005. Upper Basin Pallid Sturgeon Recovery Workgroup, 2004 Annual Report, August 2005. Last accessed online May 8, 2007 at http://fwp.mt.gov/FwpPaperApps/conservation/species/2004PallidAR_pages1to47.pdf.

URS Corporation (URS), 2007. *Protocol for Endangered Species Analysis.* January 2007. Austin, TX.

URS Corporation (URS), 2006. *Gateway Energy and Coke Company, LLC Application for Construction Permit.* July 2006. Oak Ridge, TN.

U.S. Environmental Protection Agency (USEPA), 2007a. Ecological Soil Screening Levels. Interim Final. Website last updated March, 2007: http://www.epa.gov/ecotox/ecossl/.

USEPA, 2007b. Species Profile: Bald Eagle. USEPA Region 1. Last Accessed online May 8, 2007 at http://www.epa.gov/region1/ge/thesite/restofriver/reports/final_era/B%20-%20Focus%20Species%20Profiles/EcoRiskProfile_bald_eagle.pdf.

USEPA, 2007c. National Ambient Air Quality Standards (NAAQS). USEPA Air and Radiation. Website last updated March 2, 2007. Last accessed online May 2, 2007 at http://www.epa.gov/air/criteria.html.

USEPA, 2006. Ecological Risk Assessment, Screening Values. Website last updated October, 2006: http://www.epa.gov/reg3hwmd/risk/eco/index.htm.

USEPA, 2005a. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.* Final. Office of Solid Waste, Washington, D.C. September 2005.

USEPA, 2005b. *Guidance for Developing Ecological Soil Screening Levels.* Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C., OSWER Directive 9285.7-55, originally published November 2003. February 2005.

USEPA, 2003. RCRA Corrective Action, Ecological Screening Levels. Website last updated March, 2006: http://www.epa.gov/reg5rcra/ca/edql.htm. August 2003.

USEPA, 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.htm.

USEPA, 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Peer Review Draft.* Office of Solid Waste, Washington, D.C. August 1999.

USEPA, 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final.* Edison, NJ. EPA/540/R-97-006. June.

USEPA, 1993. *Wildlife Exposure Factors Handbook, Vol. 1.* Office of Research and Development, United States Environmental Protection Agency, Washington, D.C. EPA/600/P-93/187a. December 1993.

U.S. Fish and Wildlife Service (USFWS), 2006a. *Species Profile: Pallid Sturgeon (Scaphirhynchus albus).* Missouri River Fish and Wildlife Management Assistance Office (FWMAO). Website last modified December 1, 2006. Last accessed online May 3, 2007 at http://www.fws.gov/moriver/PSPROFILE.htm

USFWS, 2006b. *The Pallid Sturgeon, a Missouri River "Dinosaur."* Region 6, Mountain-Prairie Region, Feature Series Vol I, No 4. Website last modified December 29, 2006. Last accessed online May 3, 2007 at http://mountain-prairie.fws.gov/feature/sturgeon.html.

USFWS, 2001. *Bald Eagle (haliaeetus leucocephalus).* USFWS Federally Listed Threatened and Endangered Species in Oklahoma. Website current as of August 2001. Last accessed online May 7, 2006 at http://www.fws.gov/southwest/es/oklahoma/eagle1.htm.

USFWS, 1997. *Threatened and Endangered Species Fact Sheet: Decurrent False Aster (Coltonia decurrans).* Last accessed online May 7, 2007 at http://www.fws.gov/midwest/endangered/plants/d-f-aster.pdf.

USFWS, 1992a. *Interior Least Tern (Sterna antillarum).* USFWS Federally Listed Threatened and Endangered Species in Oklahoma. Website current as of April 1992. Last accessed online November 8, 2006 at http://www.fws.gov/southwest/es/oklahoma/lestern.htm.

USFWS, 1992b. *Gray Bat (Myotis grisescens).* USFWS Federally Listed Threatened and Endangered Species in Oklahoma. Website current as of January 1992. Last accessed online May 7, 2006 at http://www.fws.gov/southwest/es/oklahoma/graybat.htm.

USFWS, 1992c. *Indiana Bat (Myotis sodalis).* USFWS Federally Listed Threatened and Endangered Species in Oklahoma. Website current as of February 1992. Last accessed online May 7, 2006 at http://www.fws.gov/southwest/es/oklahoma/indnbat.htm.

USFWS, 1991a. *Gray Bat (Myotis grisescens).* USFWS Division of Endangered Species, Species Accounts. Last accessed online May 3, 2007 at http://www.fws.gov/endangered/i/a/saa41.html.

USFWS, 1991b. *Indiana Bat (Myotis sodalis).* USFWS Division of Endangered Species, Species Accounts. Last accessed online May 3, 2007 at http://www.fws.gov/endangered/i/a/saa08.html.

Washington State Legislature (WSL), 2007. Washington Administrative Code (WAC) 173-400-113. April 2007. Last accessed online May 9, 2007 at http://apps.leg.wa.gov/WAC/default.aspx?cite=173-400-113.

ATTACHMENT A

USEPA Region 5 Ecological Benchmarks

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Acenaphthene	83-32-9		**38**[a]	6.71[r]	6.82 e+5
Acenaphthylene	208-96-8		4.84 e+3[b]	5.87[r]	6.82 e+5
Acetone	67-64-1	959	**1700**[a, c, z]	**9.9**[z]	2500[w]
Acetonitrile	75-05-8	17.1	**12 e+3**[d, z]	**56**[z]	1370[w]
Acetophenone	98-86-2		-----	-----	3 e+5
Acetylaminofluorene [2-]	53-96-3		535[b]	15.3	596
Acrolein	107-02-8	0.578	**0.19**[c, z]	**1.52 e-3**[z]	5270[w]
Acrylonitrile	107-13-1	0.797	**66**[a]	**1.2**	23.9[w]
Aldrin	309-00-2		**1.7 e-2**[a, z]	2[t]	3.32[x]
Allyl chloride	107-05-1	1.22		-----	13.4
Aminobiphenyl [4-]	92-67-1			-----	3.05
Aniline	62-53-3		**4.1**[d]	**0.31**	56.8[w]
Anthracene	120-12-7		**0.035**[f]	**57.2**[u]	1.48 e+6
Antimony (Total)	7440-36-0		**80**[c]		142
Aramite	140-57-8		3.09[g]	1.11 e-3	1.66 e+5
Arsenic (Total)	7440-38-2		**148**[f]	**9790**[u]	5700
Azobenzene [p-(dimethylamino)]	60-11-7		1.65[b]	318	40
Barium (Total)	7440-39-3		**220**[d, z]		1040
Benzene	71-43-2	9.76	114[f]	142	255
Benzo[a]anthracene	56-55-3		**0.025**[c, z]	**108**[u]	5210

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Benzo[a]pyrene	50-32-8		0.014[h]	**150[u]**	1520
Benzo[b]fluoranthene	205-99-2		9.07[b]	1.04 e+4	5.98 e+4
Benzo[ghi]perylene	191-24-2		7.64[b]	170[t]	1.19 e+5
Benzo[k]fluoranthene	207-8-9		-----	240[t]	1.48 e+5
Benzyl alcohol	100-51-6		**8.6[h, z]**	**1.04[z]**	6.58 e+4
Beryllium (Total)	7440-41-7		**3.6[d, k, z]**		1060
BHC [alpha-]	319-84-6		12.4[b]	6[t]	99.4
BHC [beta-]	319-85-7		0.495[b]	5[t]	3.98[x]
BHC [delta-]	319-86-8		667[g]	7.15 e+4	9940
BHC [gamma-]	58-89-9		**0.026[a]**	**2.37[u]**	5[x]
Bromodichloromethane	75-27-4			-----	540
Bromoform	75-25-2	9.11	**230[d, z]**	**492[z]**	1.59 e+4
Bromophenyl phenyl ether [4-]	101-55-3		1.5[h]	1550	
Butylamine [N-Nitrosodi-n-]	924-16-3		-----	-----	267
Butylbenzyl phthalate	85-68-7		**23[d, z]**	**1970[z]**	239
Cadmium (Total)	7440-43-9		**0.15[i, j, k]**	**990[u]**	2.22
Carbon disulfide	75-15-0	3.67	**15[d, z]**	**23.9[z]**	94.1
Carbon tetrachloride	56-23-5	1.41	**240[d]**	**1450**	2980
Chlordane	57-74-9		**4.3 e-3[j]**	**3.24[u, z]**	224[x]
Chlorethyl ether [bis(2-]	111-44-4		**19 e+3[l]**	**3520**	2.37 e+4[w]

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Chloro-1-methylethyl)ether [bis(2-]	108-60-1		-----	-----	1.99 e+4
Chloroaniline [p-]	106-47-8		232[g]	146	1100
Chlorobenzene	108-90-7	120	**47**[a]	**291**	1.31 e+4
Chlorobenzilate	510-15-6		7.16[g]	860	5050
Chloroethane	75-0-3	20	-----	-----	
Chloroform	67-66-3	1.34	**140**[d]	**121**	1190
Chloronaphthalene [2-]	91-58-7		0.396[b]	417	12.2
Chlorophenol [2-]	95-57-8		**24**[a]	**31.9**	243
Chlorophenyl phenyl ether [4-]	7005-72-3			-----	
Chloroprene	126-99-8	4.16 E-2		-----	2.9
Chromium^{+3} (Total)	7440-47-3		42[j, k]	**4.34 e+4**[u]	400[y]
Chrysene	218-1-9		-----	**166**[u]	4730
Cobalt (Total)	7440-48-4		**24**[d]	5.00 e+4[t]	140
Copper (Total)	7440-50-8		**1.58**[j, k, z]	**3.16 e+4**[u]	**5400**
Cresol [4,6-dinitro-o-]	534-52-1		**23**[m]	**104**	144
Cresol [m-]	108-39-4		**62**[d]	**52.4**	3490
Cresol [o-]	95-48-7		**67**[c]	**55.4**	4.04 e+4
Cresol [p-chloro-m-]	59-50-7		34.8[g]	388	7950
Cresol [p-]	106-44-5		**25**[a]	**20.2**	1.63 e+5
Cyanide	57-12-5		5.2[a]	0.1[t]	1330[w]

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
DDD [4,4'-]	72-54-8		-----	**4.88**[u, z]	758
DDE [4,4'-]	72-55-9		4.51 e-9[e]	**3.16**[u]	596
DDT [4,4'-]	50-29-3		**1.1 e-5**[a, z]	**4.16**[u]	**3.5**[z]
Di-n-butyl phthalate	84-74-2		**9.7**[a]	**1114**	150
Di-n-octyl phthalate	117-84-0		30[f]	4.06 e+4	7.09 e+5
Diallate	2303-16-4		-----	-----	452[w]
Dibenzofuran	132-64-9		**4**[a, z]	**449**[z]	
Dibenz[a,h]anthracene	53-70-3		-----	**33**[u]	1.84 e+4
Dibromo-3-chloropropane [1,2-]	96-12-8	0.32	-----	-----	35.2
Dibromochloromethane	124-48-1		-----	-----	2050
Dibromoethane [1,2-]	106-93-4	176	-----	-----	1230
Dichloro-2-butene [trans-1,4-]	110-57-6	4.03		-----	
Dichlorobenzene [m-]	541-73-1	273	**38**[a, z]	**1315**[z]	3.77 e+4
Dichlorobenzene [o-]	95-50-1	270	**14**[h]	**294**	2960
Dichlorobenzene [p-]	106-46-7	275	**9.4**[d, z]	**318**[z]	546
Dichlorobenzidine [3,3'-]	91-94-1		**4.5**[a, z]	**127**	646
Dichlorodifluoromethane	75-71-8	1550		-----	3.95 e+4
Dichloroethane [1,1-]	75-34-3	1240	47[h]	0.575	2.01 e+4
Dichloroethane [1,2-]	107-6-2	29.7	**910**[h]	**260**	2.12 e+4
Dichloroethene [1,1-]	75-35-4	0.303	**65**[a, z]	**19.4**[z]	8280

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Dichloroethylene [trans-1,2-]	156-60-5	29.1	**970[d]**	**654**	784
Dichlorophenol [2,4-]	120-83-2		**11[d, z]**	**81.7[z]**	8.75 e+4
Dichlorophenol [2,6-]	87-65-0			-----	1170
Dichloropropane [1,2-]	78-87-5	70.6	**360[a, z]**	**333[z]**	3.27 e+4
Dichloropropene [cis-1,3-]	10061-1-5	5.89	-----	-----	398
Dichloropropene [trans-1,3-]	10061-2-6	5.89	-----	-----	398
Dieldrin	60-57-1		**7.1 e-5[a]**	**1.9[u, z]**	2.38
Diethyl O-2-pyrazinyl phosphorothioate [O,O-]	297-97-2			-----	799
Diethyl phthalate	84-66-2		**110[a]**	**295**	2.48 e+4
Dimethoate	60-51-5		-----	-----	218
Dimethyl phthalate	131-11-3		-----	-----	7.34 e+5
Dimethylbenzidine [3,3'-]	119-93-7			-----	104
Dimethylbenz[a]anthracene [7,12-]	57-97-6		0.548[b]	6.64 e+4	1.63 e+4
Dimethylphenethylamine [alpha,alpha-]	122-9-8			-----	300
Dimethylphenol [2,4-]	105-67-9		100[b]	304	10[x]
Dinitrobenzene [m-]	99-65-0		**22[d]**	**8.61**	655
Dinitrophenol [2,4-]	51-28-5		**19[a]**	**6.21**	60.9
Dinitrotoluene [2,4-]	121-14-2		**44[d, z]**	**14.4[z]**	1280
Dinitrotoluene [2,6-]	606-20-2		**81[d]**	**39.8**	32.8

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Dinoseb	88-85-7		**0.48**[a]	**14.5**	21.8
Dioxane [1,4-]	123-91-1	367	**22 e+3**[a]	**119**	2050[w]
Diphenylamine	122-39-4		412[b]	34.6	1010
Disulfoton	298-4-4		4.02 e-2[e]	324	19.9
D [2,4-]	94-75-7		**220**[a]	**1273**	27.2
Endosulfan I	959-98-8		**0.056**[j]	**3.26**	119
Endosulfan II	33213-65-9		**0.056**[j]	**1.94**	119
Endosulfan sulfate	1031-7-8		2.22[b]	34.6	35.8
Endrin	72-20-8		**0.036**[a]	**2.22**[u, z]	10.1
Endrin aldehyde	7421-93-4		0.15[b]	**480**[z]	10.5
Ethyl methacrylate	97-63-2	356		-----	3 e+4
Ethyl methane sulfonate	62-50-0			-----	
Ethylbenzene	100-41-4	304	**14**[o, z]	**175**	5160
Famphur	52-85-7			-----	49.7
Fluoranthene	206-44-0		**1.9**[f, z]	**423**[u]	1.22 e+5
Fluorene	86-73-7		**19**[d]	**77.4**[u]	1.22 e+5
Heptachlor	76-44-8		**3.8 e-3**[j]	0.6[r]	5.98
Heptachlor epoxide	1024-57-3		**3.8 e-3**[j]	**2.47**[u]	152
Hexachlorobenzene	118-74-1		**3 e-4**[a]	20[t]	199
Hexachlorobutadiene	87-68-3		**0.053**[a, z]	**26.5**[z]	39.8

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Hexachlorocyclopentadiene	77-47-4		77[b]	901	755
Hexachloroethane	67-72-1		**8**[a, z]	**584**[z]	596
Hexachlorophene	70-30-4		0.228[e]	2.31 e+5	199
Hexachloropropene	1888-71-7		-----	-----	
Hexanone [2-]	591-78-6	105	**99**[h, z]	**58.2**[z]	1.26 e+4
Indeno (1,2,3-cd) pyrene	193-39-5		4.31[b]	200[t]	1.09 e+5
Isobutyl alcohol	78-83-1	32.8	-----	-----	2.08 e+4[w]
Isodrin	465-73-6		3.09 e-2[e]	55.2	3.32[x]
Isophorone	78-59-1		**920**[d]	**432**	1.39 e+5
Isosafrole	120-58-1			-----	9940
Kepone	143-50-0		0.132[e]	3.31	32.7
Lead (Total)	7439-92-1		**1.17**[j, k, z]	**3.58 e+4**[u]	53.7
Mercury (Total)	7439-97-6		1.3 e-3[a]	174[r]	100[y]
Methacrylonitrile	126-98-7	3.38		-----	57[w]
Methane [bis(2-chloroethoxy)]	111-91-1		-----	-----	302[w]
Methapyrilene	91-80-5			-----	2780[w]
Methoxychlor	72-43-5		**0.019**[h]	**13.6**	19.9
Methyl bromide	74-83-9	26.5	**16**[d]	**1.37**	235[w]
Methyl chloride	74-87-3	2.63		-----	1.04 e+4[w]
Methyl ethyl ketone	78-93-3	642	**2200**[a, z]	**42.4**[z]	8.96 e+4[w]

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Methyl iodide	74-88-4	11.7		-----	1230
Methyl mercury	22967-92-6		2.46 e-3[e]	0.01	1.58
Methyl methacrylate	80-62-6	87.1	2800[g]	168	9.84 e+5[w]
Methyl methanesulfanate	66-27-3			-----	315[w]
Methyl parathion	298-0-0			-----	0.292
Methyl-2-pentanone [4-]	108-10-1	45.9	**170**[h, z]	**25.1**[z]	4.43 e+5
Methylcholanthrene [3-]	56-49-5		8.91 e-2[b]	8.19 e+6	77.9
Methylene bromide	74-95-3	344		-----	6.5 e+4[w]
Methylene chloride	75-9-2	4780	**940**[a]	**159**[z]	4050[w]
Methylnaphthalene [2-]	91-57-6		330[b]	20.2[r]	3240
Naphthalene	91-20-3	80.1	**13**[a, z]	**176**[u]	99.4
Naphthoquinone [1,4-]	130-15-4		-----	-----	1670
Naphthylamine [1-]	134-32-7		-----	-----	9340
Naphthylamine [2-]	91-59-8			-----	3030
Nickel (Total)	7440-2-0		**28.9**[j, k, z]	**2.27 e+4**[u]	1.36 e+4
Nitroaniline [m-]	99-9-2			-----	3160
Nitroaniline [o-]	88-74-4			-----	7.41 e+4
Nitroaniline [p-]	100-1-6			-----	2.19 e+4
Nitrobenzene	98-95-3		**220**[a, z]	**145**[z]	1310
Nitrophenol [o-]	88-75-5		-----	-----	1600

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Nitrophenol [p-]	100-2-7		**60**[a]	**13.3**	5120
Nitroquinoline-1-oxide [4-]	56-57-5			-----	122
Nitrosodiethylamine [N-]	55-18-5		768[g]	22.8	69.3[w]
Nitrosodimethylamine [N-]	62-75-9			-----	0.0321[w]
Nitrosodiphenylamine [N-]	86-30-6		-----	-----	545
Nitrosomethylethylamine [N-]	10595-95-6			-----	1.66[w]
Nitrosomorpholine [N-]	59-89-2			-----	70.6[w]
Nitrosopiperidine [N-]	100-75-4			-----	6.65[w]
Nitrosopyrrolidine [N-]	930-55-2			-----	12.6[w]
Parathion	56-38-2		**0.013**[a, d]	**0.757**	0.34[y]
Pentachlorobenzene	608-93-5		**0.019**[a, z]	**24**[z]	497
Pentachloroethane	76-1-7	0.68	56.4[g]	689	1.07 e+4
Pentachloronitrobenzene	82-68-8		-----	-----	7090
Pentachlorophenol	87-86-5		**4.0**[j, p, z]	**2.3 e+4**[z]	119
Phenacetin	62-44-2		-----	-----	1.17 e+4
Phenanthrene	85-1-8		**3.6**[f]	**204**[u]	4.57 e+4
Phenol	108-95-2	4.31	**180**[c]	**49.1**	1.2 e+5
Phenylenediamine [p-]	106-50-3			-----	6160[w]
Phorate	298-02-2		3.62[g]	0.861	0.496
Phthalate [bis(2-ethylhexyl)]	117-81-7		**0.3**[q, z]	182[r]	925

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Picoline [2-]	109-6-8	140	-----	-----	9900[w]
Polychlorinated biphenyls	1336-36-3		**1.2 e-4**[a, z]	**59.8**[u]	0.332
Polychlorinated dibenzo-p-dioxins	PCDD-S		2.78 e-7[b]	**0.011**	1.99 e-4
Polychlorinated dibenzofurans	51207-31-9		-----	-----	0.0386
Pronamide	23950-58-5		-----	-----	13.6[x]
Propionitrile	107-12-0	1.87	-----	-----	49.8[w]
Propylamine [N-nitrosodi-n-]	621-64-7			-----	544
Pyrene	129-0-0		0.3[g]	**195**[u]	7.85 e+4
Pyridine	110-86-1	13.7	2380[g]	106	1030[w]
Safrole	94-59-7		-----	-----	404
Selenium (Total)	7782-49-2		5[j]		27.6
Silver (Total)	7440-22-4		**0.12**[f, z]	500[t]	4040
Silvex	93-72-1		**30**[a, z]	**675**[z]	109[x]
Styrene	100-42-5	0.946	**32**[d, z]	**254**[z]	4690
Sulfide	18496-25-8				3.58
Tetrachlorobenzene [1,2,4,5-]	95-94-3		**3**[a, z]	**1252**[z]	2020
Tetrachlorodibenzo-p-dioxin [2,3,7,8-]	1746-1-6		**3 e-9**[a, z]	**1.2 e-4**[z]	1.99 e-4
Tetrachloroethane [1,1,1,2-]	630-20-6	22.5	-----	-----	2.25 e+5
Tetrachloroethane [1,1,2,2-]	79-34-5	353	**380**[a]	**850**	127
Tetrachloroethene	127-18-4	69	**45**[a]	**990**	9920

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Tetrachlorophenol [2,3,4,6-]	58-90-2		**1.2**[a, z]	**129**[z]	199
Tetraethyl dithiopyrophosphate	3689-24-5		13.9[b]	560	596
Thallium (Total)	7440-28-0		**10**[a]		56.9
Tin (Total)	7440-31-5		**180**[d]		7620
Toluene	108-88-3	1040	253[f]	**1220**[z]	5450
Toluidine [5-nitro-o-]	99-55-8			-----	8730
Toluidine [o-]	95-53-4			-----	2970[w]
Toxaphene	8001-35-2		**1.4 e-4**[a, z]	**0.077**[z]	119
Trichlorobenzene [1,2,4-]	120-82-1		**30**[a, z]	**5062**[z]	1.11 e+4
Trichloroethane [1,1,1-]	71-55-6	4170	**76**[d, z]	**213**[z]	2.98 e+4
Trichloroethane [1,1,2-]	79-0-5	11.6	**500**[a, z]	**518**[z]	2.86 e+4
Trichloroethylene	79-1-6	1220	**47**[h, z]	**112**[z]	1.24 e+4
Trichlorofluoromethane	75-69-4	5150		-----	1.64 e+4
Trichlorophenol [2,4,5-]	95-95-4			-----	1.41 e+4
Trichlorophenol [2,4,6-]	88-6-2		**4.9**[d]	**208**	9940
Trichloropropane [1,2,3-]	96-18-4	3.32	-----	-----	3360
Trichlorphenoxyacetic acid [2,4,5-]	93-76-5		686[g]	5.87 e+4	596
Triethyl phosphorothioate [O,O,O-]	126-68-1		58.2[b]	189	818
Trinitrobenzene [Sym-]	99-35-4			-----	376[w]
Vanadium (Total)	7440-62-2		**12**[a, z]		1590

Chemical	CAS No.	Air mg/m^3	Water ug/l	Sediment[s] ug/kg	Soil[v] ug/kg
Vinyl acetate	108-5-4	359	248[g]	13	1.27 e+4[w]
Vinyl chloride	75-1-4	0.221	**930**[a]	**202**	646
Xylenes (total)	1330-20-7	135	**27**[d, z]	**433**[z]	1 e+4[x]
Zinc (Total)	7440-66-6		**65.7**[j, k, z]	**1.21 e+5**[u]	6620[y]

[a] = Michigan water quality standards, Rule 57 water quality values, July 23, 2003. Available at: http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-11383--,00.html. The water ESL data for acenaphthene, BHC (gamma), cyanide and parathion are Michigan (final chronic value or FCV) Tier I criteria. Likewise, water ESL data for dieldrin, dioxin, DDT, endrin, hexachlorobenzene, hexachlorobutadiene, mercury, PCB's and toxaphene represent wildlife values (see Notes at end of these footnotes for dioxin, DDT, mercury and PCB's). All of the remaining data are Tier II values.

[b] = Water Ecological Screening Level (ESL) based on exposure to a mink (*Mustela vison*).

[c] = Indiana water quality standards, Title 327, Article 2, of the Indiana Administrative Code, Feb. 4, 2002. Available at: http://www.ai.org/legislative/iac/t03270/a00020.pdf The water ESL for toxaphene is from the Indiana chronic aquatic criterion for all waters outside of mixing zones (see Table 1 under Rule 1 of 327 IAC 2-1-6 Minimum Surface Water Quality Standards at the above Internet site). The remaining water ESL data are either wildlife values (for dioxin, DDT, mercury and PCB's) or Tier II values for the Indiana Great Lakes Basin (see Great Lakes Basin Criteria and Values Table as developed under Rule 1.5 of 327 IAC Article 2 as referenced above).

[d] = Ohio water quality standards, Chapter 3745-1 of the Ohio Administrative Code, Dec. 30, 2002. Available at: http://www.epa.state.oh.us/dsw/rules/3745-1.html The water ESL data for endrin and parathion are Ohio aquatic life Tier I criteria from the Outside Mixing Zone Average (OMZA). Wildlife values are available for dioxin, DDT, mercury and PCB's. All of the remaining data are Ohio aquatic life Tier II values from the OMZA. See Ohio summary tables for water quality criteria and values along with reference on the development of Tier I criteria and Tier II values.

[e] = Water ESL based on exposure to a belted kingfisher (*Ceryle alcyon*).

[f] = Minnesota water quality standards, Rule 7052.0100, Subpart 2 (water ESL data for arsenic & benzene represents aquatic life chronic standards and dioxin, DDT, mercury and PCB's represents wildlife values), April 13, 2000. Rule 7050.0222, Subpart 2, Feb. 12, 2003. Available at: http://www.revisor.leg.state.mn.us/arule/7050/0100.html and http://www.revisor.leg.state.mn.us/arule/7052/0222.html

[g] = Region 5, RCRA Interim Criteria, based on Aquire database with acceptable review codes and endpoints (life cycle). Must have eight or more acceptable studies (i.e., chronic and/or acute).

[h] = GLWQI Tier II value as presented in: Suter, G.W. II and Tsao, C.L. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota, 1996 Revision. ES/ER/TM-96/R2. Available at: http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html

[i] = U.S. EPA 2001 Update of Ambient Water Quality Criteria for Cadmium (EPA 822-R-01-001).

[j] = U.S. EPA National Recommended Water Quality Criteria: 2002 (EPA 822-R-02-047)

[k] = For hardness-dependent metals (beryllium, cadmium, chromium^{+3}, copper, lead, nickel and zinc), freshwater chronic criteria are based on soft water with a total hardness of 50 mg/L as $CaCO_3$. Soft water is common within Region 5 and this water ESL may be recalculated when site specific water hardness is less than 50 mg/L.

[l] = U.S. EPA Ambient Water Quality for Chloroalkyl Ethers (EPA 440/5-80-030). No definitive data available concerning chronic toxicity. The water ESL is based on no adverse effects for a chronic toxicity embryo-larval test of the fathead minnow.

[m] = U.S. EPA Ambient Water Quality for Nitrophenols (EPA 440/5-80-063). The acute value of 230 ug/l was adjusted with an uncertainty factor of ten for 2,4-dinitrophenol and 4,6-dinitro-o-cresol since no chronic criteria are available.

[n] = Wisconsin Surface Water Quality Criteria and Secondary Values for Toxic Substances, NR 105.07(1)(b), Sept.1, 1997. Available at: http://www.legis.state.wi.us/rsb/code/nr/nr100.html

[o] = Illinois water quality standards, Title 35, Part 302.208, Dec. 20, 2002. Available at: http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.asp

[p] = The criterion for pentachlorophenol is pH dependent and is based on a pH of 6.5.

[q] = U.S. EPA Ambient Water Quality for Phthalate Esters (EPA 440/5-80-067). A chronic value of 3 ug/L that resulted in significant reproductive impairment was adjusted with an uncertainity factor of ten.

[r] = Environment Canada. September 1994. Interim Sediment Quality Assessment Values. Ecosystem Conservation Directorate. Evaluation and Interpretation Branch.

[s] = Unless noted otherwise, all Sediment ESLs were derived using equilibrium partitioning (EqP) equation and the corresponding water ESL. Note: Sediment ESL = K_{oc} x Water ESL x 0.01.

[t] = Ontario Ministry of the Environment. August 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario.

[u] = Consensus based threshold effect concentrations (TEC) as presented in MacDonald et. al. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch Environ Contam Toxicol 39:20-31 (see Table 2). The TEC for mercury had a high incidence of toxicity and was not used. These values do not consider bioaccumulation nor biomagnification.

[v] = Unless noted otherwise, all Soil ESLs are based on exposure to a masked shrew (*Sorex cinerus*).

[w] = Soil ESL is based on exposure to a meadow vole (*Microtus pennsylvanicus*).

[x] = Soil ESL is based on exposure to a plant.

[y] = Soil ESL is based on exposure to soil invertebrates (e.g., earthworms).

[z] = New ESL data is lower than the previous table.

Notes: New ESL data are displayed in bold font and a dashed line (e.g., -----) is used to show when data was deleted from the previous table (i.e., supporting data was inadequate). All six states in EPA Region 5 have the same water ESL's for dioxin, DDT, mercury and PCB's which are based on a wildlife value. A summary report will be created on the development of soil benchmarks including equations, criteria and references. Likewise, a report will be prepared on the development of water benchmarks that are based on mink and belted kingfisher exposure.

ATTACHMENT B

Ecological Uptake Factors and Methyl Mercury Toxicity Data

Biological Uptake Factors Used in the ERA Screening Evaluation

Analyte	Mammal UF		Bird UF		Benthic Invertebrate UF		Fish UF	
Methyl Mercury	0.192	a	0.192	a	2.868	a	17650	a

a) Chemical Specific Uptake Factors for each component of a receptor's diet were selected after evaluating various sources that provided a chemical specific uptake factor:

Mammal & Bird

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1998. Development and Validation of Bioaccumulation Models for Small Mammals. Prepared for the U.S. Department of Energy, Office of Environmental Management. February 1998. ES/ER/TM-219.

Benthic Invertebrate & Amphibians

Bechtel Jacobs Company, LLC. 1998. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation. U.S. Department of Energy, Office of Environmental Management. August 1998.BJC/OR-112.

Fish & Aquatic Invertebrates

USEPA, 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

Methyl Mercury Oral Toxicity (Mammal)

Test Species	Wt. (kg)	Endpoint	Duration	CODE	Effect	Concentration Total	Concentration as Mercury	Dose (mg/kg-BW/day)	Reference
Rat (MMC) (SPF-Wistar)	0.325	LOAEL	3 generations	C	Reproduction		in diet	0.16	Sample et al. 1996 (Verschuuren et al. 1976a)
Rat (MMC) (SPF-Wistar)	0.325	NOAEL	3 generations	C	Reproduction		in diet	0.032	Sample et al. 1996 (Verschuuren et al. 1976a)

Selected:

The 3-generation dietary study on rats by Verschuuren (1976) as cited in Sample et al. (1996) LOAEL and NOAEL are selected because it had the best available LOAEL and NOAEL for oral exposure with a preferred critical endpoint (mortality, growth, or reproduction/development) for the preferred duration (chronic). The chronic LOAEL is 0.16 m/kg-BW/day. Reduced pup viability in this reproductive endpoint test was observed at the LOAEL. The NOAEL is 0.032 mg/kg-BW/day.

Other Studies:

Other studies are not selected because they have a shorter exposure duration, a higher NOAEL/LOAEL, and/or used large animals as test species.

Test Species	Wt. (kg)	Endpoint	Duration	CODE	Effect	Concentration Total	Concentration as Mercury	Dose (mg/kg-BW/day)	Reference
Guinea Pig (MM)	1	LD_{50}	Single dose	L	Mortality			21	Toxicol Appl Pharmacol 24:545, 1973, as cited in RTECS
Mouse (MMC) (ICR)	0.0325	LOAEL	26 weeks	S	85% (M) to 98% (F) Mortality		in diet	3.1	ATSDR 1999 (Mitsumori et al. 1981)
Mink (MMC)	1	LOAEL	93 days	S	Mortality, Body Weight		in diet	0.25	Sample et al. 1996 (Woebeser et al. 1976)
Rat (F) (MMC) (Wistar)	0.32	LOAEL	8 days, gestation day 7-14	C	Developmental (decreased fetal weight, increased malformations)		gavage with water	4	ATSDR 1999 (Fuyuta et al. 1978)
Rat (F) (MMC) (ddN)	0.325	LOAEL	Once on Gestation d 6,7,8,9,10	C	Ferotoxicity and developmental abnormalities		gavage with water	24	ATSDR 1999 (Inouye and Murakami 1975)
Mouse (F) (MMH) (CFW)	0.03	LOAEL	Single dose on gestation day 8	C	Decreased number of pups per litter		gavage	3	ATSDR 1999 (Hughes and Annau 1976)
Mouse (M) (MMC) (B6C3F1)	0.04	LOAEL	104 weeks	C	83% Mortality; Reproductive (M) (tubular atrophy of testes)		in diet	0.69	ATSDR 1999 (Mitsumori et al. 1990)
Mouse (M) (MMC) (ICR)	0.0325	LOAEL	104 weeks	C	Decreased spermatogenesis		in diet	0.73	ATSDR 1999 (Hirano et al. 1986)
Monkey (F) (MMH) (Macaca)	11.4	LOAEL	4 months	C	Abortion, stillbirth, and decreased conception		gavage	0.06	ATSDR 1999 (Burbacher et al. 1988)
Guinea Pig (F) (MMC) (Hartley)	0.43	LOAEL	once on Gestation days 21, 28, 35, 42	C	Reproduction (increased abortions)		gavage with water	11.5	ATSDR 1999 (Inouye and Kajiwara 1988)

Methyl Mercury Oral Toxicity (Mammal)

Test Species	Wt. (kg)	Endpoint	Duration	CODE	Effect	Concentration		Dose (mg/kg-BW/day)	Reference
						Total	as Mercury		
Hamster (F) (MMA)	0.096	LOAEL	Once on Gestation day 8	C	Reproduction (increased abortions)		gavage with water	22	ATSDR 1999 (Gale 1974)
Mink (MMC)	1	NOAEL	93 days	S	Mortality, Body Weight		in diet	0.15	Sample et al. 1996 (Woebeser et al. 1976)
Rat (MMC) (SPF-Wistar)	0.325	NOAEL	2 years	C	Reproductive effects		in diet	0.1	ATSDR 1999 (Verschuuren et al. 1976b)
Rat (F) (MMC) (Wistar)	0.32	NOAEL	8 days, gestation days- 7-14	C	Developmental (decreased fetal weight, increased malformations)		gavage with water	2	ATSDR 1999 (Fuyuta et al. 1978)
Mouse (F) (MMH) (CFW)	0.03	NOAEL	Single dose on gestation day 8	C	Decreased number of pups per litter		gavage	2	ATSDR 1999 (Hughes and Annau 1976)
Mouse (M) (MMC) (B6C3F1)	0.04	NOAEL	104 weeks	C	83% Mortality; Reproductive (M) (tubular atrophy of testes)		in diet	0.14	ATSDR 1999 (Mitsumori et al. 1990)
Mouse (M) (MMC) (ICR)	0.03	NOAEL	104 weeks	C	Decreased spermatogenesis		in diet	0.15	ATSDR 1999 (Hirano et al. 1986)
Hamster (F) (MMA)	0.096	NOAEL	Once on Gestation day 8	C	Reproduction (increased abortions)		gavage with water	15.8	ATSDR 1999 (Gale 1974)
Monkey (F) (MMH) (Macaca)	11.4	NOAEL	4 months	C	Reproduction		gavage	0.04	ATSDR 1999 (Burbacher et al. 1988)

Mature rat body weight (average male & female) = 0.325 kg, USEPA 1988
Mature rat food consumption (average male & female) = 0.0265 kg/day, USEPA 1988

CD1 - Calculated Dose = Diet (mg/kg) x 1/BW (kg) x Food Ingestion (kg/day) or
CD2 - Calculated Dose = Total Dose (mg/kg-BW)/Test Duration (days)

DURATION CODE: L = LD_{50}; A = Acute; S = Subchronic; C = Chronic

CHEMICAL CODE: (MM) = Methyl mercury; (MMA) = Methyl mercury acetate; (MMC) = Methyl mercury chloride; (MMH) = Methyl mercury hydroxide

SEX CODE: (M) = Male; (F) = Female

References:

Agency for Toxic Substances and Disease Registry (ATSDR). March 1999. Toxicological Profile for Mercury. Division of Toxicology. Atlanta, Georgia.

Burbacher TM, Mohamed MK, Mottett NK. 1988. Methylmercury effects on reproduction and offspring size at birth. Reprod Toxicol 1(4):267-278.

Fuyuta, M., T. Fujimoto, and S. Hirata. 1978. Embryotoxic effects of methylmercuric chloride administrated to mice and rats during organogenesis. Teratoloty 18:353-366.

Gale, T.F. 1974. Embryopathic effects of different routes of administration of mercuric acetate on the hamster. Environ. Res. 8:207-213.

Hirano, M. Mitsumori K., Maita K., et al. 1986. Further Carcinogenicity Study on Methylmercury chloride in ICR Mice. Jap J. Vet Sci. 48 (1):127-135.

Methyl Mercury Oral Toxicity (Mammal)

Test Species	Wt. (kg)	Endpoint	Duration	CODE	Effect	Concentration		Dose (mg/kg-BW/day)	Reference
						Total	as Mercury		

Hughes JA, Annau Z. 1976. Postnatal behavioral effects in mice after prenatal exposure to methylmercury. Pharmacol Biochem Behav 4:385-391.

Inouye M, Murakami U. 1975. Teratogenic effect of orally administered methylmercuric chloride in rats and mice. Congenital Anomalies 15:1-9.

Inouye, M., and Y. Kajiwara. 1988. Developmental disturbances of the fetal brain in guinea-pigs caused by methylmercury. Arch. Toxicol. 62(1):15-21.

Mitsumori K, Maita K, Saito T, et al. 1981. Carcinogenicity of methylmercury chloride in ICR mice: Preliminary note on renal carcinogenesis. Cancer Lett 12:305-310.

Mitsumori K, Hirano M, Ueda H, et al. 1990. Chronic toxicity and carcinogenicity of methylmercury chloride in B6C3F1 mice. Fundamental and Applied Toxicology 14:179-190.

Registry of Toxic Effects of Chemical Substances (RTECS) Online Database provided by the Canadian Centre for Occupational Health and Safety (CCOHS).

Sample, B.E., D.M. Opresko, G.W. Suter II. 1996.Toxicological Benchmarks for Wildlife: 1996 Revision.Risk Assessment Program Health Sciences Research Division, Oak Ridge,TN. Prepared for the Dept. of Energy.

USEPA. 1988. Recommendations for and documentation of biological values for use in risk assessment. Environmental Criteria and Assessment Office. Cincinnati, OH. EPA/600/6-87/008.

Verschuuren, H.G., R. Kroes, E.M. Den Tonkelaar, J.M. Berkvens, P.W. Helleman, A.G. Rauws, P.L. Schuller, and G.J. Van Eschl. 1976a. Toxicity of methylmercury chloride in rats. III.Reproductive study. Toxicol 6:97-106.

Verschuuren, H.G., R. Kroes, E.M. Den Tonkelaar, J.M. Berkvens, P.W. Helleman, A.G. Rauws, P.L. Schuller, and G.J. Van Eschl. 1976b. Toxicity of methylmercury chloride in rats. III. Long-term toxicity study. Toxicol 6:107-123.

Wobeser, G., N.O. Nielson, and B. Schiefer. 1976. Mercury and mink II. Experimental methyl mercury intoxication. Can. J. Comp. Med. 34-45.

Methyl Mercury Oral Toxicity (Bird)

Test Species	Wt. (kg)	Endpoint	Duration	CODE	Effect	Concentration Total	Concentration as Mercury	Dose (mg/kg-BW/day)	Reference
Mallard (MMD)	1	LOAEL	3 generations	C	Reproduction (fewer eggs and ducklings-mortality)		diet	0.064	USEPA 1999 (Heinz 1979)

Selected:

The chronic LOAEL of 0.064 mg/kg-BW/day from a dietary study by Heinz (1979) as cited in USEPA (1999) for a 3-generation reproductive study with mallard duck was selected because it had the lowest LOAEL with a preferred critical endpoint (mortality, growth, or reproduction/development) for the preferred duration (chronic). There were fewer eggs and higher duckling mortality at the LOAEL. The chronic NOAEL is selected by dividing the chronic LOAEL by an uncertainty factor of 5, resulting in a chronic NOAEL of 0.013 mg/kg-BW/day, which is more conservative than the chronic NOAEL studies by March et al. (1983) and Hill (1981) as cited in Eisler (1987).

Other Studies:

Other studies are not selected because they are of a shorter exposure duration.

Test Species	Wt. (kg)	Endpoint	Duration	CODE	Effect	Concentration Total	Concentration as Mercury	Dose (mg/kg-BW/day)	Reference
Mallard (MM)	1	LD_{50}	Single dose	L	Mortality		2.2 to 23.5	2.2	Eisler 1987 (Hudson et al. 1984)
Fulvous Whistling Duck (MM)		LD_{50}	Single dose	L	Mortality			37.8	Eisler 1987 (Hudson et al. 1984)
Coturnix Quail (MM)	0.15	LD_{50}	Single dose	L	Mortality		11 to 27	11	Eisler 1987 (Hill 1981)
Japanese Quail (MM)	0.15	LD_{50}	Single dose	L	Mortality		14.4 to 33.7	14.4	Eisler 1987 (Hill and Soares 1984) (Hudson et al. 1984)
Northern Bobwhite (MM)	0.167	LD_{50}	Single dose	L	Mortality			23.8	Eisler 1987 (Hudson et al. 1984)
House Sparrow (MM)	0.0277	LD_{50}	Single dose	L	Mortality		12.6 ro 37.8	12.6	Eisler 1987 (Hudson et al. 1984)
Ring-necked Pheasant (MM)	1.135	LD_{50}	Single dose	L	Mortality		11.5 to 26.8	11.5	Eisler 1987 (Hudson et al. 1984)
Gray Pheasant (MM)		LOAEL	30 days	C	Reproduction			0.64	Eisler 1987 (McEwen et al. 1973)
Black Duck (MM)	1	LOAEL	28 wks	C	Reproduction significantly inhibited		3 mg/kg-diet	$0.142^{(2)}$	Eisler 1987 (Finley and Stendell 1978)
Chicken (MM)	1.7	NOAEL	28 weeks	S	Clinical Signs		0.45 mg/kg-diet	0.0311^{CD1}	Eisler 1987 (March et al. 1983)
Quail (MM)	0.15	NOAEL	Hatch to 9 weeks	C	Survival		4 mg/kg-diet	$0.311^{(1)}$	Eisler 1987 (Hill 1981)

Methyl Mercury Oral Toxicity (Bird)

Bird food ingestion (kg/day) (all birds) = 0.0582 x $BW^{0.651}$(kg), USEPA 1993
Mature mallard body weight (female) = 1 kg, Heinz et al. 1989
Chicken food ingestion (kg/day) = 0.075 x $BW^{0.8449}$(kg), USEPA 1988
Chicken body weight (mature) = 1.7 kg, USEPA 1988

CD1 - Calculated Dose = Diet (mg/kg) x 1/BW (kg) x Food Ingestion (kg/day) or
(1) - Dose based on actual food consumption and body weights provided by Hill.
(2) - Dose based on actual food consumption and body weights provided by Finley and Stendell (1978).

DURATION CODE:
L = LD_{50}
S = Subchronic
C = Chronic

CHEMICAL CODE: (MM) = Methyl mercury
(MMD) = Methyl mercury dicyandiamide

References:

Eisler, R. 1987. Mercury hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Fish and Wildlife Service. Biological Report 85 (1.10)

Finley, M.T., and R.C. Stendell. 1978. Survival and reproductive success of black ducks fed methyl mercury. Environ. Pollut. 16:51-64.

Heinz, G.H. 1979. Methylmercury: Reproductive and Behavioral Effects on Three Generations of Mallard Duck. J. Wildl. Mgmt. 43:394-401.

Hill, E.F. 1981. Inorganic and organic mercury chloride toxicity to coturnix: Sensitivity related to age and quantal assessment of physiological responses. Ph.D. Thesis, Univ. Maryland, College Park. 221 pp.

Hill, E.F., and J.H. Soares, Jr. 1984. Subchronic mercury exposure in Coturnix and a method of hazard evalaution. Environ. Toxicol. Chem. 3:489-502.

Hudson, R.H., R.K. Tucker, and M.A. Haegele. 1984. Handbook of toxicity of pesticides to wildlife. U.S. Fish Wildl. Serv. Resour. Publ. 153. 90 pp.

March, BE, R Poon, and S Chu. 1983. The dynamics of ingested methyl mercury in growing and laying chickens. Poult Sci 62:1000-1009.

McEwen, L.C., R.K. Tucker, J.O. Ells, and M.A. Haegele. 1973. Mercury-Wildlife Studies by the Denver Wildlife Research Center. Pages 146-156 in D.R. Buhler (ed.). Mercury in the Western Environment. Oregon State Univ., Corvallis.

USEPA. 1988. Recommendations for and documentation of biological values for use in risk assessment. Environmental Criteria and Assessment Office. Cincinnati, OH. EPA/600/6-87/008.

USEPA. 1993. Wildlife Exposure Factors Handbook. EPA/600/P-93/187a.

USEPA 1999. Screening level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA/530-D-99-001. August.

ATTACHMENT C

Bioaccumulation Factors and Hazard Quotient Calculations

Table C-1. HQ Calculations for Bald Eagle
Granite Energy and Coke Company
Granite City, Illinois

Bald Eagle COC	Surface Water Conc (mg/L)	Sediment Conc (mg/kg)	Mammal UF (unitless)	Mouse Tissue Conc (mg/kg)	Bird UF (unitless)	Bird Tissue Conc (mg/kg)	Fish UF (unitless)	Fish Conc (mg/kg)	Selected Contaminated Food	Selected Contaminated Food Conc	Total Daily Dose Rate (mg/kg BW-day)	NOAEL Toxicity Reference Value (mg/kg BW-day)	LOAEL Toxicity Reference Value (mg/kg BW-day)	NOAEL Hazard Quotient (unitless)	LOAEL Hazard Quotient (unitless)
Methyl Mercury	4.6E-10	2.4E-05	1.9E-01	4.6E-06	1.9E-01	4.6E-06	1.8E+04	8.2E-06	Fish	8.2E-06	3.0E-07	1.3E-02	6.4E-02	2.3E-05	4.7E-06

insect [ ]

Surface h2O, sediment, & food ingestion / bw

Table C-2. HQ Calculations for Least Interior Tern
Granite Energy and Coke Company
Granite City, Illinois

Least Interior Tern COC	Surface Water Conc (mg/L)	Sediment Conc (mg/kg)	Fish UF (unitless)	Fish Conc (mg/kg)	Selected Contaminated Food	Selected Contaminated Food Conc	Total Daily Dose Rate (mg/kg BW-day)	NOAEL Toxicity Reference Value (mg/kg BW-day)	LOAEL Toxicity Reference Value (mg/kg BW-day)	NOAEL Hazard Quotient (unitless)	LOAEL Hazard Quotient (unitless)
Methyl Mercury	4.6E-10	1.9E-02	1.8E+04	8.2E-06	Fish	8.2E-06	1.9E-04	1.3E-02	6.4E-02	1.4E-02	2.9E-03

Table C-3. HQ Calculations for Gray Bat
Granite Energy and Coke Company
Granite City, Illinois

Gray Bat COC	Surface Water Conc (mg/L)	Sediment Conc (mg/kg)	Insect UF (unitless)	Insect Conc (mg/kg)	Selected Contaminated Food	Selected Contaminated Food Conc	Total Daily Dose Rate (mg/kg BW-day)	NOAEL Toxicity Reference Value (mg/kg BW-day)	LOAEL Toxicity Reference Value (mg/kg BW-day)	NOAEL Hazard Quotient (unitless)	LOAEL Hazard Quotient (unitless)
Methyl Mercury	4.6E-10	1.9E-02	2.9E+00	5.3E-02	Insect	5.3E-02	8.2E-03	3.2E-02	1.6E-01	2.5E-01	5.1E-02

Table C-4. HQ Calculation for the Indiana Bat
Granite Energy and Coke Company
Granite City, Illinois

Indiana Bat COC	Surface Water Conc (mg/L)	Sediment Conc (mg/kg)	Insect UF (unitless)	Insect Conc (mg/kg)	Selected Contaminated Food	Selected Contaminated Food Conc	Total Daily Dose Rate (mg/kg BW-day)	NOAEL Toxicity Reference Value (mg/kg BW-day)	LOAEL Toxicity Reference Value (mg/kg BW-day)	NOAEL Hazard Quotient (unitless)	LOAEL Hazard Quotient (unitless)
Methyl Mercury	4.6E-10	1.9E-02	2.9E+00	5.3E-02	Insect	5.3E-02	8.6E-03	3.2E-02	1.6E-01	2.7E-01	5.4E-02

ATTACHMENT D

Daily Dose Equations

Daily Dose Equations

Bald Eagle

$$Dose_{oral} = \frac{(C_w \times WI) + (C_s \times SI) + (0.8C_w \times UF_f \times FI) + (0.1C_s \times UF_m \times FI) + (0.1C_{s/w} \times UF_b \times FI)}{BW}$$

Least Interior Tern

$$Dose_{oral} = \frac{(C_w \times WI) + (C_s \times SI) + (C_w \times UF_f \times FI)}{BW}$$

Gray Bat

$$Dose_{oral} = \frac{(C_w \times WI) + (C_s \times SI) + (C_s \times UF_i \times FI)}{BW}$$

Indiana Bat

$$Dose_{oral} = \frac{(C_w \times WI) + (C_s \times SI) + (C_s \times UF_i \times FI)}{BW}$$

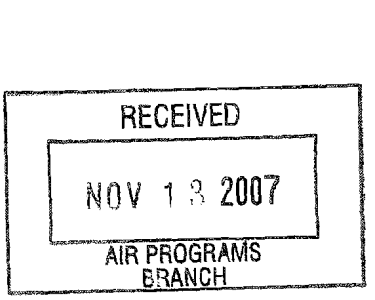
Where:

BW = Body weight
C_s = Concentration in sediment
C_w = Estimated concentration in water
SI = Soil or sediment ingestion rate
FI = Food ingestion rate
UF_b = Uptake factor for birds
UF_i = Uptake factor for benthic invertebrates
UF_f = Uptake factor for fish → $[H_2O]$
UF_m = Uptake factor for mammals
WI = Water ingestion rate

Enclosure 3

Delauna A. Pack
Director Corporate HES
SunCoke Energy, Inc.
11400 Parkside Drive
Knoxville, TN 37934
865 288 5291 Phone
865 288 5280 Fax

November 2, 2007



Mr. Mike Coffey
U.S. Fish and Wildlife Services
1511 47th Avenue
Moline, Illinois 61265

Ecological Risk Assessment Addendum

Dear Mr. Coffey:

Gateway Energy and Coke Company (GECC) wishes to provide the attached information to supplement the Ecological Risk Assessment Screening Evaluation submitted on August 15, 2007. This Addendum has been prepared in response to comments received from Jennifer Darrow, USEPA Region 5, on September 25, 2007 regarding the impacts of NOx emissions from the facilities, in addition to local background levels, to be evaluated for the decurrent false aster. The GECC ERA submitted in August found that the proposed construction of the facility is unlikely to directly or indirectly adversely affect the federally listed species potentially present in the surrounding area.

The purpose of this evaluation was to determine whether proposed construction of the GECC facility adjacent to United States Steel's Granite City Works (GCW) in Granite City, Illinois, is likely to directly or indirectly adversely affect the decurrent false aster, a federally listed (i.e., endangered or threatened) species potentially present in the surrounding area based on anticipated changes to NOx emissions.

GECC proposes to construct a heat recovery coke making facility adjacent to United States Steel's GCW in Granite City, Illinois. Construction of the heat recovery coke plant will be accompanied by several other improvements at GCW. The heat recovery coke plant at GECC and the blast furnace gas boiler and flare at GCW will potentially emit 701 tons of NOx per year. However, other improvements at GCW will reduce NOx emissions by 804 tons per year – resulting in a net reduction of NOx emissions of 103 tons per year. The impacts of these new projects were conservatively evaluated by considering that all of the potential 701 NOx emissions were added to the area without considering any of the reductions.

The risk associated with emissions of NOx was modeled using actual emission rates rather than a unit-emission-rate approach. Emissions of NOx occur almost entirely from the main stack. As such, the actual emissions of NOx from the main stack and that from the proposed GCW blast furnace boiler and flare, along with the other GECC point sources (pushing, waste heat stacks), were modeled using maximum annual NOx emission rates. Deposition values used were consistent with vapor phase modeling approaches as described elsewhere in the GECC application material. Values at selected receptors were calculated and passed along to the risk phase of the assessment.

For nitrogen oxides (NOx), maximum deposition rates (g/m^2) calculated by AERMOD were compared to the deposition ESL recommended by EPA Region 5 and FWS based on data gathered for the ExxonMobil ESA (ExxonMobil, 2005) and utilized in the ConocoPhillips ESA (ConocoPhillips, 2007). A copy of the information provided by EPA Region 5 and FWS has been provided in Attachment 1. Both facilities were located in an urban setting. Similarly, since the GECC facility is in a similar urban setting to both facilities and only located 14 miles away from the ConocoPhillips facility, the same ExxonMobil NOx background data was utilized in this GECC ERA screening evaluation. The nitrogen deposition values for each receptor location were utilized directly from AERMOD and directly compared to the ESL for NOx.

In addition, the maximum calculated yearly air concentrations were added to the average background NOx concentration. Each of the receptor location total NOx concentrations were compared to the annual average phytotoxicity guideline (WHO, 2000), established for air quality in Europe. This phytotoxicity concentration is an appropriate guideline for direct exposure of NOx species to plants.

The decurrent false aster, a federally threatened species, plays an important role in the aquatic/riparian food web as a dietary item for herbivorous and omnivorous mammals and birds, as well as attracting insects for insectivorous birds. The decurrent false aster, which grows in river floodplains and wetlands, is potentially exposed to COPCs through root uptake from riparian soil/sediment and surface water. The potential for NOx emissions from the facility to pose a risk to the decurrent false aster was evaluated in this ERA screening evaluation by comparing the NOx calculated deposition concentrations and total air concentrations (maximum calculated air concentrations and the background air concentration) to an ESL and phytotoxicity guideline, respectively. As shown in Table 1, the maximum deposition increase related to the project is 0.00505 g/m^2, which is much less than the deposition ESL of 0.5 g/m^2.

When the project NOx total concentrations are compared to the phytotoxicity guideline of 30 $\mu g/m^3$, the total of the NOx exposure concentrations at all receptor locations are much less than the phytotoxicity guideline (see Table 1). Therefore, retention of NOx as an ecological COPC for the decurrent false aster is not warranted.

The results of this ERA screening evaluation of NOx indicate that the proposed construction of the GECC is unlikely to directly or indirectly adversely affect the federally listed species potentially present in the surrounding area.

If you have any questions regarding the enclosed information, please contact me at 865.288.5291.

Sincerely,

Delauna Pack
Director Corporate HES

Attachments

cc: Jennifer Darrow, USEPA
Larry Siebenberger, GCW

Table 1. NOx Deposition Rates and Air Concentrations Compared to Ecological Screening Levels

Receptor #	X	Y	Concentration from Project ($\mu g/m^3$)[a]	Background Concentration ($\mu g/m^3$)[b]	Total Concentration (Background & Project) ($\mu g/m^3$)	Phytotoxicity Guideline ($\mu g/m^3$)[c]	Estimated Total Dry Deposition from AERMOD (g/m^2)[a]	Ecological Screening Level (g/m^2)[b]
R1	749400	4286830	1.55	0.71	2.26	30	0.00505	0.5-1.0
R2	749447	4286818	1.36	0.71	2.08	30	0.00446	0.5-1.0
R3	749489	4286872	1.40	0.71	2.11	30	0.00472	0.5-1.0
R4	749239	4287035	1.20	0.71	1.91	30	0.00432	0.5-1.0
R5	749445	4286851	1.52	0.71	2.23	30	0.00501	0.5-1.0
R6	751538	4285646	0.43	0.71	1.14	30	0.00164	0.5-1.0
R7	745300	4286105	0.11	0.71	0.82	30	0.00045	0.5-1.0

[a] Based on the 5 year maximum estimated concentration or dry deposition rate.

[b] ConocoPhillips, 2007. Endangered Species Act Deposition Modeling Results and Discussion for CORE Project WRB Refining – Wood River Refinery, Roxana Illinois. Background and ecological screening values provided to ExxonMobil for 2005 ESA evaluation by US EPA Region 5 and US Fish and Wildlife Service. This value was utilized by ConocoPhillips in the 2007 ESA for their facility located 14 miles away from the Gateway facility. All three facilities are in urban areas.

[c] Annual average phytotoxicity guideline (WHO, 2000).

Attachment 1
Ecological Screening Level Documentation Provided by US EPA Region 5 and FWS to ExxonMobil for Use in the 2005 ESA

Determination of Nitrogen Effects for ExxonMobil

The following provides a brief discussion of the potential adverse effects to leafy prairie clover, and eastern prairie fringed orchid from Nitrogen deposition. Information provided by ExxonMobil raises two questions: 1) Is 1g/m2/yr an appropriate threshold value above which we would conclude that a listed species would be adversely affected by a proposed action, but below which we would determine that the proposed action is not likely to adversely affect the listed species? 2) If that threshold value seems too high, what would be a more appropriate value?

ExxonMobil proposes a threshold value of 1g/m2/yr for Nitrogen deposition based on WHO air quality guidelines for Europe, which indicated a critical load value (similar to a no adverse effects level or NOEL), or between 1-1.5g/m2/yr. That value was associated with a decline in sensitive species in a species rich heathland.

ExxonMobil determined that the current background level of Nitrogen deposition is 0.71g/m2/yr., that Indeck adds a small fraction of 0.01g/m2/yr (based upon Calpuff modeling), and that the project would add 0.08g/m2/yr, suggesting that the total Nitrogen deposition after construction of ExxonMobil will be 0.8g/m2/yr (below ExxonMobil's proposed threshold value of 1.0g/m2/yr).

Weiss (1999) found that bay checkerspot butterfly populations had declined or become extirpated in areas with higher Nitrogen deposition. Sites that received Nitrogen deposition of 1.0-1.5 became invaded by introduced grasses (e.g., *Lolium),* which crowded out the butterfly's host plant. Sites that had deposition in the range of 0.4 to 0.6g/m2/yr did not become invaded by introduced grasses. Serpentine soils are Nitrogen limited. Exxon Mobil indicated that the deposition values reported by Weiss may be low because wet deposition was not accounted for. However, our read of the paper indicated that the author did consider wet deposition, and that it is likely lower than estimated by ExxonMobil. Even if the wet deposition figure used by ExxonMobil is correct, and adverse affects are present at 1.1g/m2/yr, and absent at 0.7g/m2/yr, that would suggest a threshold value below 1g/m2/yr.

Stevens et al. (2004) found that for every 0.25g/m2/yr, one could expect a reduction of a single species. ExxonMobil suggested that this paper may not be appropriate because it evaluated nitrogen deposition in acid grasslands. Stevens et al. (2000) show a regression with data points beginning at 0.5g/m2/yr, and species diversity declining as nitrogen deposition increases beyond that point.

Wedin and Tilman (1996) looked at Nitrogen addition and noted that it was associated with the loss of species diversity, with the greatest losses occurring between 1 and 5g/m2/yr. The graph they present shows losses beginning below an application of 1g/m2/yr. Chris Clark (Graduate Student in Tilman's lab at Cedar Creek, 2005 pers. comm.) indicated that the graph showing effects below 1g/m2/yr was based upon an extrapolation. Based on their work they suggest that a threshold value of 0.5g/m2/yr may be appropriate (Clark 2005, pers. comm.).

Suding et al. 2005 examined a number of studies and concluded that species that are rare in their environment, or nitrogen fixers, or perennial are more likely to become extirpated than are other species.

Summary:

WHO indicates that 1-1.5g/m2/yr is sufficient to protect sensitive species in species rich heathlands, Weiss (1999) found that serpentine grasslands retained native species at deposition rates of 0.4 to 0.6g/m2/yr, but had become invaded by non native grasses at 1.0 - 1.5g/m2/yr, Stevens et al. (2004) indicated that on average, for every 0.25g/m2/yr of Nitrogen deposition a single species would be lost. Wedin and Tilman noted most losses in species diversity between 1 and 5g/m2/yr. Clark (2005, pers. comm.) indicated that a threshold value of 0.5g/m2/yr may be appropriate. These studies suggest that losses in diversity, and increased abundance of weedy species, occurs at Nitrogen deposition rates below 1 g/m2/yr, likely between 0.5g/m2/yr and 0.7g/m2/yr.

This analysis suggests that there is reason to believe that the current background level of 0.7g/m2/yr is close to a threshold value, and may already be causing losses in species diversity by favoring invasive species. ExxonMobil's addition of 0.08g/m2/yr, when added to the background level, would put Nitrogen deposition at levels where studies show losses in biodiversity and increased abundance of invasive species. The presentation in these studies shows a linear effect, suggesting that ExxonMobil's addition would be noticeable.

Literature Cited:

Stevens, C. I., N.B. Disc, J.O. Mountford, and D.J. Gowing. 2004. Impact of Nitrogen Deposition on the Species Richness of Grasslands. Science 303: 1876-1879.

Suding, K. N., S.L. Collins, L. Gough, C. Clark, BE. Cleland, K.L. Gross, D.G. Milchunas, and S. Pennings. 2005. Functional- and Abundance-based Mechanisms Explain Diversity Loss due to N Fertilization. Proceedings National Academy of Sciences. 102(12):4387-4392.

Wedin, D.A. and D. Tilman. 1996. Influence of Nitrogen Loading and Species Composition of the Carbon Balance of Grasslands. Science 274: 1720-1723.

Weiss, S.B. 1999. Cars, Cows, and Checkerspot Butterflies: Nitrogen Deposition and Management of Nutrient-Poor Grasslands for a Threatened Species. Conservation Biology 13(6):1476-1486.

World Health Organization. 2000. Air Quality Guidelines for Europe, second edition. WHO Regional Publications, European Series No. 91.

Attachment 2
References

ConocoPhillips, 2007. Endangered Species Act Deposition Modeling and Discussion for CORE Project for WRB Refining – Wood River Refinery, Roxana, Illinois. Prepared by Trinity Consultants for ConocoPhillips. Submitted to EPA Region 5 on April 17, 2007.

ExxonMobil, 2005. Endangered Species Impacts Assessment for ExxonMobil Oil Corporation – Joliet Refinery, Unit Reliability – Efficiency Improvement Projects, Prepared by Cambridge Environmental for ExxonMobil. Submitted to EPA Region 5 on August 3, 2005.

World Health Organization (WHO), 2000. *Air Quality Guidelines for Europe.* 2nd Ed. Copenhagen: World Heath Organization Regional Office for Europe. Available online at: http://www.euro.who.int/document/e71922.pdf.

Enclosure 4

Third Addendum to the August 2007 Ecological Risk Assessment
Gateway Energy and Coke Company
February 18, 2008

As per the conference call on February 11, 2008, held between the Environmental Protection Agency (EPA) Region 5, US Fish and Wildlife Service (FWS), SunCoke, and URS Corporation these conservative assumptions were revised to provide a more likely, less conservative analysis of mercury emissions and dispersion.

Emission Rate

Most of the mercury emissions from the facility will be emitted from the main stack. Lesser amounts are emitted from the waste heat stacks and from charging. A carbon injection system to remove mercury will be incorporated with the spray dryer/baghouse that control emissions from the main stack. Based on limited information available at the time, the original emissions estimate (used for the Ecological Risk Assessment) assumed 20% removal. The carbon injection system will be designed for 90% mercury removal. The revised analysis assumes 90% mercury removal form main stack emissions. A copy of the draft permit conditions that show the current 90% requirement were previously submitted in an email dated January 30, 2008. Emissions from the waste heat stacks and charging were not changed. The uncontrolled mercury emissions from revised analysis continue, as in the original evaluation, to be based on an AP-42 emission factor. This factor is conservative in that analysis of the mercury levels in the coals actually used at SunCoke facilities indicates that this number is high by a factor of 3.

Air Dispersion and Deposition Modeling

The original dispersion modeling used to support the risk assessment was based on the point source emission units from the proposed Granite City Coke facility, and used particulate matter emissions as the surrogate for mercury. This was a conservative approach especially considering that emissions associated with coke pushing activities accounted for most of the modeled unit-emission-rate impacts and deposition values. The revised analysis included only those point sources that will emit mercury, and not including the pushing activities. Removing the pushing activities from the modeling and accounting for the other emission reductions returned much lower ground level unit-emission-rate concentrations and deposition values. Figures 1 and 2 provide the isopleths for annual and 1 hour mercury dispersion and deposition.

Results

The revised air dispersion and deposition modeling was incorporated into the fate and transport model along with the new emission rate for mercury (7.05E-04 grams/second). In addition, a new receptor location (Receptor 8) was added to the evaluation as requested by FWS. Figure 3 presents the receptor locations including the new Receptor 8 (R8). Tables 1 and 2 presents the

Helen_Artz_Patton@URSCorp.com

To

02/18/2008 03:32 PM

Subject ERA Addendum 3 for Gateway Energy and Coke Company

Please find attached the electronic versions of the Third Addendum to the Ecological Risk Assessment (ERA) for Gateway Energy and Coke Company. The purpose of the Addendum is to provide additional information discussed in a conference call on November 11, 2008 with the USEPA Region 5, US Fish and Wildlife Service, SunCoke, and URS Corporation. SunCoke agreed to address the comments in this third Addendum to the ERA. This advance electronic copy is being provided for your convenience and with consideration of the pressing schedule, a timely review of this material would be greatly appreciated.

The attached files include the cover letter to Jennifer Darrow (USEPA Region 5) and the Third Addendum. The three figures will follow in a complete hard copy as the electronic files are too large to e-mail. Please note that the complete hard copies will be sent out overnight for tomorrow morning delivery.

The third addendum presents revised estimated soil and sediment concentrations for mercuric chloride and methyl mercury. The revisions removed very conservative assumptions made in the original air dispersion and deposition modeling and in developing the emission rates. The revised concentrations are orders of magnitude lower than both the background levels and the ecological benchmarks.

(See attached file: Mercury Addendum_18February2008.pdf)

Sincerely,
Helen

Helen Artz Patton
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URS Corporation
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Tel: 512.454.4797
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Helen_Artz_Patton@urscorp.com

URS

February 18, 2008

Ms. Jennifer Darrow
USEPA Region 5
77 West Jackson Boulevard
Mail Code: AR 18J
Chicago, Illinois 60604-3507

Gateway Energy & Coke Company
Ecological Risk Assessment – Third Addendum

Dear Jennifer,

On behalf of Gateway Energy and Coke Company, URS is pleased to submit the third Addendum to the Ecological Risk Assessment (ERA). Per our conference call on February 11, 2008, the Environmental Protection Agency (EPA) Region 5, US Fish and Wildlife Service (FWS), SunCoke, and URS Corporation discussed EPA and FWS comments on the December 2007 Second Addendum and Revised Pages for the ERA for Gateway Energy and Coke Company. As a result of that call, SunCoke agreed to address the comments in a third Addendum to the ERA. The third addendum is attached.

Please contact Delauna Pack at 865.288.5291 or myself at 512.419.6152 if you have any questions or need additional information.

Sincerely,

Helen Cotter Patton

cc:
D. Pack, SunCoke
M. Coffey, FWS
J. Schnepp, IEPA
L. Siebenberger, GCW

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Third Addendum to the August 2007 Ecological Risk Assessment
Gateway Energy and Coke Company
February 18, 2008

As per the conference call on February 11, 2008, held between the Environmental Protection Agency (EPA) Region 5, US Fish and Wildlife Service (FWS), SunCoke, and URS Corporation these conservative assumptions were revised to provide a more likely, less conservative analysis of mercury emissions and dispersion.

Emission Rate

Most of the mercury emissions from the facility will be emitted from the main stack. Lesser amounts are emitted from the waste heat stacks and from charging. A carbon injection system to remove mercury will be incorporated with the spray dryer/baghouse that control emissions from the main stack. Based on limited information available at the time, the original emissions estimate (used for the Ecological Risk Assessment) assumed 20% removal. The carbon injection system will be designed for 90% mercury removal. The revised analysis assumes 90% mercury removal form main stack emissions. A copy of the draft permit conditions that show the current 90% requirement were previously submitted [or are attached? John] Emissions from the waste heat stacks and charging were not changed. The uncontrolled mercury emissions from revised analysis continue, as in the original evaluation, to be based on an AP-42 emission factor. This factor is conservative in that analysis of the mercury levels in the coals actually used at SunCoke facilities indicates that this number is high by a factor of 3.

Air Dispersion and Deposition Modeling

The original dispersion modeling used to support the risk assessment was based on the point source emission units from the proposed Granite City Coke facility, and used particulate matter emissions as the surrogate for mercury. This was a conservative approach especially considering that emissions associated with coke pushing activities accounted for most of the modeled unit-emission-rate impacts and deposition values. The revised analysis included only those point sources that will emit mercury, and not including the pushing activities. Removing the pushing activities from the modeling and accounting for the other emission reductions returned much lower ground level unit-emission-rate concentrations and deposition values. Figures 1 and 2 provide the isopleths for annual and 1 hour mercury dispersion and deposition.

Results

The revised air dispersion and deposition modeling was incorporated into the fate and transport model along with the new emission rate for mercury (7.05E-04 grams/second). In addition, a new receptor location (Receptor 8) was added to the evaluation as requested by FWS. Figure 3 presents the receptor locations including the new Receptor 8 (R8). Tables 1 and 2 presents the

Third Addendum to the August 2007 Ecological Risk Assessment
Gateway Energy and Coke Company
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comparison of cumulative estimated and background soil and sediment concentrations of mercuric chloride and methyl mercury for each receptor to ecological benchmarks.

As shown in Table 1, the estimated soil concentrations at each receptor, background concentration and the total concentrations for mercuric chloride are below the ecological benchmark for all receptors (R1 through R8). For methyl mercury, the estimated soil concentrations are several orders of magnitude lower than both background (6.00E-02 mg/kg) and the ecological benchmark (1.58E-03 mg/kg). The background level of methyl mercury in soil exceeds the benchmark. Therefore, the total concentrations for methyl mercury (estimated soil concentration plus background) exceed the benchmark solely due to the background concentrations. Since the estimated soil concentrations are several orders of magnitude lower than both background concentrations and the ecological benchmarks, the emissions from the facility are not likely to cause measurable change in current conditions or adverse effects to threatened and endangered species.

As shown in Table 2, the estimated sediment concentrations at each receptor (R6 and R7), background concentration and total concentrations for mercuric chloride are below the ecological benchmarks. For methyl mercury, the estimated sediment concentrations are several orders of magnitude lower than both background (1.5E-02 mg/kg) and at least one order of magnitude below the ecological benchmark (1.00E-05 mg/kg). The background level of methyl mercury in sediment exceeds the benchmark. Therefore, the total concentrations for methyl mercury (estimated sediment concentration plus background) exceed the benchmark solely due to the background concentrations. Since the estimated sediment concentrations are several orders of magnitude lower than background concentrations and at least an order of magnitude lower than the ecological benchmarks, the emissions from the facility are not likely to cause measurable change in current conditions or adverse effects to threatened and endangered species.

Table 1. Soil Mercuric Chloride and Methyl Mercury Cumulative Concentrations and Ecological Benchmarks

Hazardous Air Pollutant	Maximum Soil Concentration (mg/kg)	Background Soil Concentration[2] (mg/kg)	Total Soil Concentration[3] (mg/kg)	USEPA Region 5 ESL (mg/kg)
Receptor Location 1 (R1)				
Mercuric chloride[1]	2.16E-03	6.00E-02	6.22E-02	1.00E-01
Methyl mercury	4.30E-05	**6.00E-02**	**6.00E-02**	1.58E-03
Receptor Location 2 (R2)				
Mercuric chloride[1]	2.88E-03	6.00E-02	6.29E-02	1.00E-01
Methyl mercury	5.74E-05	**6.00E-02**	**6.00E-02**	1.58E-03
Receptor Location 3 (R3)				
Mercuric chloride[1]	5.86E-03	6.00E-02	6.59E-02	1.00E-01
Methyl mercury	1.17E-04	**6.00E-02**	**6.01E-02**	1.58E-03
Receptor Location 4 (R4)				
Mercuric chloride[1]	1.72E-03	6.00E-02	6.17E-02	1.00E-01
Methyl mercury	3.44E-05	**6.00E-02**	**6.00E-02**	1.58E-03
Receptor Location 5 (R5)				
Mercuric chloride[1]	4.35E-03	6.00E-02	6.43E-02	1.00E-01
Methyl mercury	8.68E-05	**6.00E-02**	**6.01E-02**	1.58E-03
Receptor Location 6 (R6)				
Mercuric chloride[1]	8.65E-05	6.00E-02	6.01E-02	1.00E-01
Methyl mercury	1.73E-06	**6.00E-02**	**6.00E-02**	1.58E-03
Receptor Location 7 (R7)				
Mercuric chloride[1]	3.75E-04	6.00E-02	6.04E-02	1.00E-01
Methyl mercury	7.48E-06	**6.00E-02**	**6.00E-02**	1.58E-03
Receptor Location 8 (R8)				
Mercuric chloride[1]	1.57E-03	6.00E-02	6.16E-02	1.00E-01
Methyl mercury	3.12E-05	**6.00E-02**	**6.00E-02**	1.58E-03

[1] The ecological benchmark for mercury (total) was used.

[2] The background values are metropolitan area background values from Illinois Environmental Protection Agency (Illinois EPA) Tiered Approach to Corrective Action Objectives (TACO), Appendix A, Tables G and H.

[3] The sum of the maximum concentration and background concentration.

Bold = Exceeds ecological benchmark.

ESL = Ecological Screening Levels.

kg/day = Kilograms per day.

NA = Not available.

Table 1. Soil Mercuric Chloride and Methyl Mercury Cumulative Concentrations and Ecological Benchmarks (Continued)

USEPA = U.S. Environmental Protection Agency.

USEPA Eco SSL = Ecological Soil Screening Levels (USEPA, 2007a).

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

RAIS = The Risk Assessment Information System (ORNL, 2006).

Table 2. Sediment Mercuric Chloride and Methyl Mercury Cumulative Concentrations and Ecological Benchmarks

Hazardous Air Pollutant	Maximum Sediment Concentration (mg/kg)	Background Sediment Concentration[2] (mg/kg)	Total Sediment Concentration[3] (mg/kg)	USEPA Region 5 ESL (mg/kg)
Receptor Location 6 (R6)				
Mercuric chloride[1]	2.09E-07	1.50E-02	1.50E-02	1.74E-01
Methyl mercury	1.70E-09	**1.50E-02**	**1.50E-02**	1.00E-05
Receptor Location 7 (R7)				
Mercuric chloride[1]	2.44E-05	1.50E-02	1.52E-02	1.74E-01
Methyl mercury	3.77E-06	**1.50E-02**	**1.50E-02**	1.00E-05

[1] The ecological benchmark for mercury (total) was used.

[2] The background values are from Mitzelfelt (1996). If a normalized range was given, the higher end of the range was selected.

[3] The sum of the maximum concentration and background concentration.

Bold = Exceeds ecological benchmark.

ESL = Ecological Screening Levels.

kg/day = Kilograms per day.

NA = Not available.

USEPA = U.S. Environmental Protection Agency.

USEPA Region 5 ESL = RCRA Corrective Action, ESLs (USEPA, 2003).

USEPA Region 4 ESL = Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment (USEPA, 2001).

USEPA Region 3 ESL = Ecological Risk Assessment, Screening Values (USEPA, 2006).

RAIS = The Risk Assessment Information System (ORNL, 2006).